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THE GREEK WARSHIP.

I.

THE controversy as to the arrangement of the oars in ancient warships has been, in one aspect and with the due exceptions, a controversy between the scholars and the sailors, in which, while the sailors cannot well be wrong on their own ground, the same impossibility hardly applies to their opponents. When the practical seaman points out that superposed banks of oars, in the accepted¹ sense, are a frank impossibility, it is hardly a conclusive reply to tell him that his acquaintance with the authorities leaves something to be desired. It follows, that for anyone who, like the present writer, is convinced that the sailors are right, the real interest of the question is this: does the evidence compel me, or even invite me, to believe in a practical impossibility?

¹ By 'the accepted theory' in this paper I mean the group of solutions (they are legion) which, though differing in details of arrangement, agree in this, that a trireme had three banks of oars at a substantial interval one over the other, a quinquereme five, a dekeres ten, and so forth, each oar rowed by one man and the lowest bank fairly near the water. (I do not include Bauer, or so much of Assmann as relates to breit-polyereis.) All these solutions rest on a common basis and fall together if that be destroyed. The most important current expression of this theory, beside Mr. Torr's, is Assmann's hoch-polyeres theory (art. *Seewesen* in Baumeister and several papers, notably *Jahrb.* 1889, p. 91, *Zur Kenntniss der Antiken Schiffe*), followed by Droysen, *Griechische Kriegsaltertümer* in Hermann's *Lehrbuch*; Luebeck, *Das Seewesen der Griechen und Römer*, 2 vols. 1890; and Schmidt, *Ueber griechische Dreireiher*, 1899; to judge by Luebeck's article *biremis*, it will be adopted in the new Pauly-Wissowa. Bauer's theory (*Griechische Kriegsaltertümer* in Müller's *Handb. d. klass. Alt.-Wiss.*, 1893, and several papers), that a trireme had a very slight interval between the banks and that ships larger than triremes never had more than three banks but employed more than one man to an

oar, is quite a separate matter. Important is Admiral Fincati's *Le Triremi*, 1881; a trireme had three oars to one bench, like a Venetian galley a zenzile. I unfortunately only know this book in Serre's translation, at the end of Vol. 1 of his *Marines de la guerre*, 1885 and 1891, from which I cite it. I cannot classify Admiral Serre; though accepted, I believe, in France, his views seem to bear little relation to the evidence. Weber's book *Die Lösung des Trierenrätsels*, published 1896, but written much earlier, with many blunders and mistranslations, contains ideas. A trireme had three men to an oar, a quinquereme five, etc. Accepted by Speck, *Handelsgeschichte*, 1900. Weber has no monopoly in mistranslations. The best exposition of the accepted theory prior to Assmann is probably that of Cartault, *La Trière Athénienne*, 1881. I understand he afterwards agreed with Bauer. While this paper was in the press two important articles appeared: one by Mr. Torr in *Dar.-Sagl. s.v. navis*, which seems to state his version of the accepted theory more definitely than was done in *Ancient Ships*; the other by Mr. A. B. Cook in Whibley's *Companion to Greek Studies*, who favours the Venetian theory, but not very decidedly. References to Torr in this paper are to *Ancient Ships* unless otherwise stated.

If it does, the fact obviously has a very real bearing on the question of the degree of credibility to be attached to ancient history generally; and this

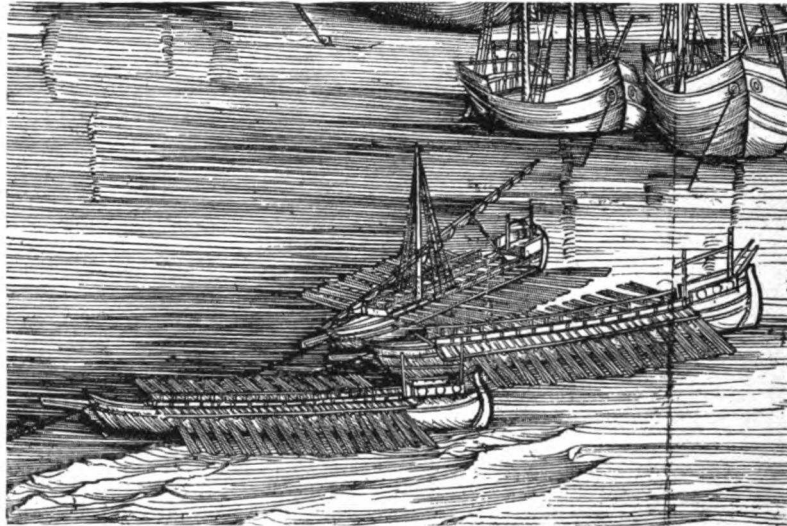


FIG. 1.—GROUP OF VENETIAN TRIREMES A ZENZILE.

From a wood-cut in the British Museum, dated 1500, by Jacopo de' Barbari. (Large view of Venice, Mitchell Collection, 1895. 1. 22. 1195.)

seems to me to be the true importance of what has become known as the 'trireme-problem.' The object of this paper is simply to examine evidence,



FIG. 2.—SMALL PORTION OF A VENETIAN BIREME A ZENZILE, SHOWING THE ARRANGEMENT OF THE ROWERS.

From a wood-cut in the British Museum, late fifteenth century (1866. 7. 14. 48*). This appears to be a state galley, and is at rest, with the crew sitting in her.

and to try to ascertain primarily what quinqueremes and triremes were *not*, with a view to clearing the ground: the period to be considered ends in

effect with *Actium*,² which closes an epoch in naval warfare. The positive conclusion appears to be that the Greek system was analogous to the Venetian, *i.e.* that a trireme was in the nature of a trireme a *zenzile*, and that the large ships of the last three centuries B.C. were galleys a *scaloccio*.³

Apart from the Athenian lists, which are conclusive for what they state, the evidence falls mainly into three classes; (1) historians and inscriptions, (2) scholiasts and lexicographers, (3) monuments. Class (1) varies in weight but includes all the best evidence. Class (2) has no independent value at all; at best it can only be used to illustrate Class (1). Where they disagree Class (1) must prevail. Probably Mr. Torr is right in saying that Class (2) can be neglected altogether. In Class (3) every item must be taken on its own merits; one may be of great value, another worthless. This class requires a more thorough going criticism than it has ever received or than I am competent to give.⁴ Many supporters of the accepted theory are inconsistent; they may begin, like Assmann, by saying that Class (2) is not trustworthy; they always end by relying upon it. This paper is intended to be based primarily on Class (1). For obvious reasons I have had to consider Class (2) to a certain extent; I have never relied on it myself and I do not consider it evidence.

The following propositions seem to represent the facts of the case.⁵

A.—The terms *thranite*, *zugite*, *thalamite*, have nothing to do with the horizontal rows (or banks) of oars. The rowers were in three divisions, or squads, *thranites* astern, *zugites* amidships, *thalamites* in the bows. This applies to triremes and the larger *polyereis*.⁶

B.—The terms *τρίκροτος δίκροτος* and *μονόκροτος* refer primarily to these squads.

C.—There is no evidence of any kind, good or bad, for the dogma that, among Greeks and Romans, at all times and in all places, one man rowed one oar; but there is good evidence (1) that in the triremes of the Peloponnesian war one man rowed one oar and (2) that the same applies to the Athenian quadriremes and quinqueremes of the fourth century.

D.—There is some evidence (1) that in the first century B.C. more than one man sometimes rowed one oar and (2) that the larger *polyereis* were too

² I have had to notice the boats on Trajan's column, and one or two other matters, and, of course, writers of later date.

³ A trireme a *zenzile* was one in which three men sat on one bench on the same level, one a little astern of the other, each rowing one oar, the three oars issuing through one opening side by side, and giving the appearance of a bundle of three oars (see Figs. 1 and 2). In the galley a *scaloccio* several men rowed each oar.

⁴ The monumental evidence is often overrated. Even in the case of the best monuments,

one can never say how far the artist may have sacrificed truth of detail to artistic considerations. It will be considered under E.

⁵ However little one wishes to dogmatise, one cannot always be writing in the potential mood and expressing every shade of proper reservation.

⁶ By 'the larger *polyereis*' in this paper I generally mean quadriremes to dekereis both inclusive, nothing over a dekereis being heard of in action.

low in the water, too light, and of too simple an arrangement, to admit of the accepted theory being applicable to them.

E.—There is no good evidence, and very little bad, that can be made to refer to the accepted theory. There is none that necessitates, or even invites, this theory.

It remains to consider the evidence for these propositions,⁷ and the conclusions to be drawn from them; and, finally, to consider the Athenian trireme.

A.

Polyaen. 5, 43. 'Calliades, overtaken by a swifter ship, kept using his steerage frequently, according as (the pursuer) tried to ram now from one side and now from the other, so that the pursuer, striking his steerage with her catheads, might not be able to ram by reason of her ram being over against his first (*i.e.*, sternmost) thranite oars.'⁸ That is to say, as the boat behind made her shot, Calliades put on his steerage; the ram missed his stern and slid past it toward, pointing at, his sternmost oars, while the cat-head struck his stern, and of course too high to do much harm; this checked the pursuer's way for the moment, and while she was straightening herself for another shot Calliades would gain a little on his new tack. The oars the ram pointed at were the first or endmost *thranite* oars. On the accepted theory they would have been the first or endmost oars of all three classes. The thranite oars therefore were in a group at the stern.

Polyaen. 3, 11, 14. Chabrias prepared a second set of steering oars for rough weather which he put out through the *παρεξαιρεσία* beside the thranite oars (*κατὰ τὰς θρανίτιδας κώπας*). His avowed object was to prevent the steering oars leaving the water as the ship's stern lifted, and of course the oars that they were put out beside can only have been the sternmost oars. The thranite oars then are the sternmost oars. On Assmann's theory no sense can be given to the words 'the thranite oars' at all;⁹ for as he supposes that the thranite oars were rowed through the

⁷ *A* is very old as an *opinion*. *B* and a good deal of *D* (2) are new, I think. *C* (1) is given correctly by Bauer. *D* (1) is primarily Weber. In referring in this paper to Bauer's arrangement I mean his arrangement considered physically, *i.e.*, as a slight interval only between the rows, apart from questions like the meaning of thranite or *παρεξαιρεσία*.

⁸ τῷ τὴν ἐμβολὴν εἶναι κατὰ τὰς πρώτας θρανίτιδας κώπας. The only writer known to me who cites this passage is Breusing, *Die Lösung des Trierenrätsels*, 1889; and as he could not understand it at all, he said that the words from τῷ τὴν ἐμβολὴν to the end must be a gloss. If one may discard everything as a gloss that does not suit one's own theory, one

can prove anything. No one who has seen a bumping race, and watched the cox of the boat in front washing off the nose of the boat behind with his steerage, will have any difficulty in construing the passage. I quote Polyaeus throughout from Woelfflin-Melber. He made considerable use of Ephorus; but according to Melber, *Ueber den Quellen und der Wert der Strategemensammlung Polyäns*, (1885), the passages most material to this paper (5, 43; 3, 11, 7 and 12 and 13; 5, 22, 2) are derived from some earlier work on naval tactics.

⁹ Assmann has to translate it (Baumeister, 1616) 'neben den hintersten Thranitenriemen,' which is not in the Greek.

παρεξαιρεσία and the others through portholes below, if the steering oars were put through the *παρεξαιρεσία* they could not be beside any oars but thranite oars, and the words are redundant and meaningless. The necessary sense is 'beside the sternmost oars.'¹⁰

Polyb. 16, 3 (battle of Chios). Philip's dekeres rams a trihemiolia¹¹ in the middle of the hull under the thranite 'thole.'¹² On the accepted theory this can only mean 'between the thranite and zugite banks.' The difficulty is twofold: (1) historians never (I think) mention the *height* at which a ship is struck: their references are always longitudinal, so to speak. They distinguish between blows *ὑφάλα* and *ἐξάλα*; otherwise they appear to assume, as all monuments (and all reason) shows, that the ram, if not submerged, was near the waterline; (2) even if the trihemiolia were lower than a trireme, the dekeres, if I am right as to its height, (see under *D*), cannot have had its ram placed as high as the 'zugite' bank; while if the accepted theory be true, then, even if the trihemiolia were as high as a trireme, the far taller dekeres must have cut her right down with the stem and could not be said to ram her 'under' anything.—The passage is of course not conclusive.¹³

¹⁰ This passage, unlike the former, is not evidence against anyone but those who accept Assmann's view (based on the monuments) of the *παρεξαιρεσία* as an outrigger or 'oar-box' (Riemen-kasten); however, as it is conclusive that Assmann is right on this point, this is not very material. Chabrias' new steering oars were not where the old ones were. The new ones were through the *παρεξαιρεσία*; therefore, the old ones were not. But the old ones were in the usual place on the stern of the ship, as shewn by their lifting clear of the water; therefore the old view, that by *παρεξαιρεσία* is meant the stern (and bow) of the ship *beyond* the oarage, is untenable. The same conclusion is supported by *Peripl. Pont. Eur.* 3, the waves coming in not only through the oar-holes but over the *παρεξαιρεσίαι* (where the reference *must* be to a *higher* point, not a *different* point); and by the frequent references to ships losing part of their *παρεξαιρεσία* in action (Thuc. 7, 34 is a good instance). But the absolutely decisive passage is Polyæn. 3, 11, 13; Chabrias stretches skins over the *παρεξαιρεσία* of each side of the ship (*ὑπὲρ τὴν παρεξαιρεσίαν ἑκατέρου τοίχου*) and nails them to the deck above, thus making a *φράγμα* which prevented the waves washing in and the oarsmen looking out. Chabrias here improvised a cataphract. Assmann never really proved his own theory of the *παρεξαιρεσία*; at the same time there is nothing in Buresch's attack on it, *Die Ergebnisse der neueren Forschung über die alten Trieren* (*Woch. für klass. Phil.* 1891, No. 1).

¹¹ In a Rhodian inscription of the first

half of the first century B.C. (*I.G.* xii. fasc. i. No. 43) trihemioliai are contrasted with cataphracts, and again triremes with aphracts; suggesting that the trihemiolia was then a smaller or less important ship than a trireme. The form *τριηρημιολία* (Ath. 203 d) suggests that Photius is right in calling it a trireme; if so, it was a light trireme evolved from a hemiolia (as to which see n. 22), as the trireme from the pentekontor. The suggestion that it means a ship of 2½ banks is the merest guesswork.

¹² *κατὰ μέσον τὸ κύτος ὑπὸ τὸν θρανίτην σκαλόν.* Cited by Weber.

¹³ As I shall often have to refer to the battle of Chios, I should note that some writers (e.g. Beloch, *Bevölkerung*, and Ihne) doubt the accuracy of Polybius' version, obviously drawn from Rhodian sources, that it was a defeat for Philip. But even if so, this cannot affect the details of single events, which are precisely given; for even if the Rhodians wrote up an account of the battle for the honour of Rhodes and Theophiliscus, they would take all the more care to put in details that either did happen or might, consistently with nautical probability, have happened. The account of this battle is hardly affected by Polybius' supposed inaccuracies as to the first Punic war, for which his sources were far different. One cannot go into the case for Polybius in a note; but I would point out (1) that, as to the numbers, no one, I think, has yet examined the numbers in the sea-fights generally up to Actium, and the only examina-

Is there any counter-evidence, *i.e.*, evidence for the view that thranite refers to the men in the highest row or bank of a trireme, zugite to those in the middle row or bank, thalamite to those in the lowest, however the rows were arranged? All that I have ever seen cited belongs (except Pollux) to Class (2) and is given below¹⁴; I know of no other.¹⁵ I have collected these passages so that it may be seen at a glance that all of them (except the first half of Schol. *Frogs* 1074 and one from Eustathius and that from Pollux) represent *one* statement only, namely, that given in the latter half of Schol. *Frogs* 1074.

If the latter half of this Scholion on *Frogs* 1074 is all one sentence, what it says is 'The τάξις which is κάτω is the thalamites, that which is μέση is the zugites, that which is ἄνω is the thranites. Therefore, the thranite is astern, the zugite in the middle, the thalamite toward the prow.' Everyone (except Weber) has omitted the οὖν. Now if οὖν means 'therefore,' it follows of course that by ἄνω the Scholiast means 'astern' and not 'above'—the consequence of sitting ἄνω is that you sit astern—and by κάτω he means 'in the bows' and not 'below.'¹⁶ Any supporter of the accepted

tion for part of the period that I know of—Kromayer, *Die Entwicklung der röm. Flotte vom Seeräuberriege des Pompeius bis zum Schlacht von Actium* (Philol. 1897), p. 426—accepts the great numbers recorded for the war with Sextus Pompey; (2) that to bring in the population question (Beloch, *Serre*) is surely to explain *obscurum per obscurius*; (3) that the real exaggeration is not in the separate accounts of battles, which generally mention 'ships' or 'cataphracts,' but in the summing-up chapter (1, 63), where Polybius has used πεντήρεις when he ought to have said warships, as appears both from the separate accounts and from the *columna rostrata* (*C.I.L.* 1, 195); and (4) that Ihne's objection (*Röm. Gesch.* 2, 47) that the Romans had ships before the first Punic war, neglects the obvious explanation that Polybius or his authority means no more in speaking of the creation of the Roman fleet than we might in speaking of the creation of the German fleet—a first serious bid for sea-power. See also n. 91.

¹⁴ Schol. *Frogs* 1074 τῶν θαλάμακι τῶν κωπηλατοῦντι ἐν τῇ κάτω μέρει τῆς τριηροῦς τῶν θαλάμακι οἱ θαλάμακες ὀλίγον ἐλάμβανον μισθὸν διὰ τὸ κολοβαῖς χρῆσθαι κώπαις παρὰ τὰς ἄλλας [Γ] τάξεις τῶν ἐρετῶν οἱ μᾶλλον ἦσαν ἐγγύς τοῦ ὕδατος. || ἦσαν δὲ τρεῖς τάξεις τῶν ἐρετῶν καὶ ἡ μὲν κάτω θαλαμίται, ἡ δὲ μέση ζυγίται, ἡ δὲ ἄνω θρανίται. θρανίτης οὖν ὁ πρὸς τὴν πρύμναν, ζυγίτης ὁ μέσος, θαλάμιος ὁ πρὸς τὴν πρῶραν. (I cite down to || from Rutherford's ed. of the scholia (1896); he does not give the latter half, which is therefore not in the *codex Ravennas*.

I cite it from the *codex Venetus*. In the former half, according to the facsimile published by the Hellenic Society, *cod. Ven.* omits Γ.) Schol. *Ach.* 162 τῶν ἐρεττόντων οἱ μὲν ἄνω ἐρεττόντες θρανίται λέγονται, οἱ δὲ μέσοι ζυγίται, οἱ δὲ κάτω θαλάμιοι. Hesych. θρανίτης ὁ πρὸς τὴν πρύμναν, ζυγίτης ὁ μέσος, θαλάμιος ὁ πρὸς τὴν πρῶραν (so Suidas and Zonaras). Hesych. θαλάμιος ἐρέτης ὁ κατωτάτω ἐρέσσων ἐν τῇ νηὶ θαλάμιος λέγεται, ὁ δὲ μέσος ζύγιος, ὁ δὲ ἀνώτατος θρανίτης. θαλάμιοι κώπαι οἱ κατωτάτω καὶ οἱ ταύτην ἔχοντες τὴν χώραν θαλάμιοι λέγονται. Suidas. θρανίτης λεῶς τῶν γὰρ ἐρεττόντων οἱ μὲν ἄνω θρανίται λέγονται, οἱ δὲ μέσοι ζυγίται, οἱ δὲ κάτω θαλάμιοι. Etym. Mag. θαλαμίδιοι κώπαι ὁ κατωτάτος ἐρέτης θαλάμιος λέγεται, ὁ δὲ μέσος ζύγιος, ὁ δὲ ἀνώτατος θρανίτης. Eustath. 1818, 52 ἔχει δὲ, φησὶν (Pausanias), οὗτος (thranite) τὴν ἄνω ἔδραν, τὴν δευτέραν ζύγιος, τὴν τρίτην θαλάμιος. 640, 11 θαλαμίται καὶ θαλάμακες ἐρέται οἱ ὑπὸ τοὺς θρανίτας. Lastly Pollux 1, 87 καλοῖτο δ' ἂν καὶ θάλαμος οὗ οἱ θαλάμιοι ἐρέττονσι: τὰ δὲ μέσα τῆς νεῶς ζύγα, οὗ οἱ ζύγιοι καθήνται: τὸ δὲ περὶ τὸ κατὰ στρωμα θράνος, οὗ οἱ θρανίται.—There is another scholion on *Frogs* 1074, given by Zuretti, *Scolii ad Plauto ed alle Rane d'Aristofane dal codice Veneto 472 e dal codice Cremonense* 12229, l. 6, 28: τρεῖς τάξεις ἦσαν ἐν τῇ τριήρει: οἱ μὲν πρῶτοι θρανίται καλούμενοι, οἱ δὲ δεύτεροι ζυγίται, οἱ δὲ τρίτοι θαλάμακες. Read with Eustath. 1818, 52, this illustrates the use of πρῶτος as sternmost in Polyæn. 5, 43 above.

¹⁵ Unless it be Ar. *Mech.* 4, discussed under *F*.

¹⁶ That ἄνω and κάτω mean 'astern' and

theory must say then either that *οὖν* here means, not 'therefore,' but something indeterminate, such as 'well, then;' or else that the sentence is two separate scholia, combined in an unintelligent manner. Either is possible, though neither can be shewn to be correct; but in any case it is certain that this scholion and the similar passages depend on the meaning of *ἄνω* and *κάτω*.

Pollux 1, 87 is different, and suits my view at least as well as the accepted theory, even if Pollux be referring only to triremes, which we have no right to assume.

Remains Eustath. 640, 11. If this is not (as I think it is) Eustathius' own misunderstanding of *κάτω*, then the question arising is, are we to follow on the one hand Eustathius, or on the other Polyaeus (twice) and (in effect) Arrian (see *B*)? The answer admits of no possible doubt.

What it then comes to is this. In order to say that the terms *thranite*, *zugite*, and *thalamite* refer to longitudinal rows or banks one over the other, we must take the latter portion of the Scholion on *Frogs* 1074, say it is evidence, translate it in a way that, at best, cannot be shown to be correct, and use the result, with the (possible) help of Eustathius, to overrule two passages in Polyaeus, possibly one in Polybius and (in effect) Arrian (see *B*); and having done this, we land after all in the difficulty in which everyone is landed by the fact that all the higher values, as shewn by that inconvenient *tesserakonteres*, only possessed the same three classes of oarsmen.¹⁷ I may add that my view explains that thorn in the side of the accepted theory, the greater number of the *thranite* oars as compared with the *zugite* and *thalamite* oars, which the Athenian lists render certain.

B.

The terms that correspond to the division of the rowers on a warship into squads are *τρίκροτος*, *δίκροτος*, and *μονόκροτος*, which are usually referred to the (triple) beat of the three banks of a trireme, the (double) beat of the

'in the bows' has often been asserted but never proved. I believe it is correct, but my reason for thinking so is given in *B*; it has nothing to do with the Schol. on *Frogs* 1074. If it be correct, all the *ἄνω* and *κάτω* passages given in the note are disposed of conclusively.

¹⁷ This forced Assmann to explain *e.g.* a *dekere* as constituted by three superposed triads, each triad consisting (in superposition) of a *thranite*, *zugite*, and *thalamite*; with a lonely *thalamite* on the top. The *τεσσερακοντήρης* is legitimate evidence so far as it goes. Since the inscription about the *τριακοντήρης* was found, no one can suppose it to be a bad joke of Callixenus': and the idea that it was a kind of flat-bottomed river barge (Assmann, Droysen, Torr) seems to me to be disposed of by the fact

that Philopator *had* such a barge (the *θαλαμηγός* of Ath. 204 d. *seq.*). If any one will read Athenaeus consecutively he will see that he puts side by side three monsters of three different types; the *τεσσερακοντήρης* (longship), the *θαλαμηγός* (*ποτάμιον πλοῖον*), and Hiero's ship (round ship). The height of the *tesserakonteres*, on which rests the 'Mississippi steamer' theory, is given to the top of the *ἄκροστέλιον*, which (*pace* Liddell and Scott) is *not* the gunwale, see Torr, 68. Those who treat *διπρωρος* as *ἀμφίπρωρος* have forgotten the old Calais-Douvres; and the twin hull was only the logical outcome of the common practice of lashing two ships together to get a steady platform.

two banks of a bireme, and the (single) beat of the one bank of a *μονήρης*. There is no evidence for this whatever, and if it were true one ought to find *τετρακίκροτος* and so forth, forms that never occur. The conventional explanation of their non-occurrence, given by Graser and repeated by Cartault and Luebeck, *viz.*, that the larger polyereis did not appear to an *observer from the side* to have more than a *triple* beat, is futile; why did any ship, *from the side*, appear to have more than a single beat? ¹⁸ The words must apply to some arrangement which was threefold and no more; and it can hardly be a coincidence that precisely the same point arises over the words *thranite*, *zugite*, and *thalamite*.

The important passage is Arr. *Anab.* 6, 5, 2,¹⁹ generally cited, together with a note that *δίκροτος* = *διήρης*, to shew how near to the water was the lower bank of a bireme. The explanation is unfortunate, as Alexander had no biremes with him. Indeed they were not in use in his time. No one seems to have considered this preliminary point.

To take things in order. Arr. *Anab.* 5, 8, Alexander carries his ships over from the Indus to the Hydaspes, triakontors in three sections, the smaller boats in two. 6, 1. He builds on the Hydaspes many triakontors and hemioliai, also horse-transporters and other transports. 6, 2. The fleet that started down the Hydaspes, according to Ptolemy, consisted of eighty triakontors, together with horse-transporters, *cercuri*, and river boats, some being native boats, and some newly built. 6, 5, 2. (At the junction of the Hydaspes and the Acesines) the cargo boats (*στρογγύλα*) came through the rapids safely; but the warships (*μακραί*) suffered, as they were lower in the water, and those of them that were *δίκροτοι* had their *κάτω* oars not much above the water; and two were lost. 6, 14. He builds more ships in the land of the Malli. 6, 15, 1. He receives some more triakontors and some cargo boats (*στρογγύλα*). 6, 15, 4. He refits. 6, 18, 3. On his expedition from Patala to the sea he takes the swiftest of the hemioliai, all the triakontors, and some *cercuri*. 6, 18, 4. The waves get up and he loses some triakontors. Arr. *Ind.* 19. On the Hydaspes, Alexander had about 800 vessels, both warships (*μακραί*) and cargo boats (*στρογγύλα*) and horse-transporters and food-transporters. 23. Nearchus loses two warships (*μακραί*) and a *cercurus*, in a storm. 31. Nearchus (requiring a good ship for special service) sends a triakontor—the island story. No other writer adds anything.²⁰

Two things come out strongly from this: (1) the important warships were the triakontors; (2) the *only* warships were the triakontors and hemioliai, for Arrian does not count a *cercurus* ²¹ as *μακρά* (*Ind.* 23). The warships

¹⁸ If there was a visible triple beat on *any* view, what becomes of the stock comparison with the wings of a bird?

¹⁹ ὅσαι τε δίκροτοι αὐτῶν (*i.e.* τῶν μακρῶν νεῶν) τὰς κάτω κώπας οὐκ ἐπὶ πολὺ ἐξω ἔχουσιν τοῦ ὕδατος.

²⁰ Curtius, Diodorus, and Justin are silent. Plutarch (*Alex.* 63) says he built *πορθμεῖα*

κωπήρη καὶ σχεδίας.

²¹ For *cercurus* see Torr *s.v.*; a type equally suited for warfare or commerce, but always reckoned among the small craft of a fleet; he has a lot of evidence. Weber's idea that a *cercurus* was a trireme is a mere mistranslation of App. *Pun.* 121.

then that were *δίκροτοι* were either triakontors or hemioliai. But whatever *δίκροτος* means, it is certain that a hemiolia was not *δίκροτος*.²² The ships that were *δίκροτοι* then were triakontors, *i.e.*, *μονήρεις* of fifteen oars aside. Consequently, *δίκροτος* does not primarily mean a bireme, whatever the lexicographers say, and does not therefore refer to the double beat of a bireme's two banks of oars, supposing it to have had such.

If then *δίκροτος* does not mean 'double-beating,'²³ it can only mean 'double-beaten.' Now *συγκεκροτημένοι* is the common term for a trained crew, 'beaten together,' or 'welded together'—(we sometimes say *ground together*); *δίκροτος* therefore means 'double-welded,' a ship whose crew is trained in, or falls into, two squads.²⁴

Now we can get at the meaning of *ἄνω* and *κάτω*. A triakontor had two squads of rowers, and, though single-banked, the oars were distinguished as those *κάτω* from those something else, presumably *ἄνω*. In relation to the oarage, therefore, *κάτω* and *ἄνω* mean fore and aft;²⁵ and this is confirmed by the usage of *κατά* and *ἀνά*.²⁶ This explains the Schol. on *Frogs* 1074, in

²² App. *Mith.* 92 the pirates originally (*πρωτων*) used myoparones and hemioliai, later (*εἰτα*) *δίκροτοις* and triremes, *i.e.*, when they organised themselves. This is conclusive; and overrules Hesych. *ἡμιολία· ἡ δίκροτος ναῦς*, where the definite article makes nonsense anyhow. I want to make this clear, because the accepted explanation of *ἡμιολία* is a ship with 1½ banks. There is not a shred of evidence for this; it rests on the fact that *ἡμιόλιος* means 1½. I might say that hemiolia means a ship of 1½ squads, which has at least the support of Photius *s.v.* *ὅ τὸ ἡμιόλιον μέρος ψιλὸν ἐρετῶν ἐστὶ πρὸς τὸ ἀπ' αὐτοῦ μάχεσθαι*. The certain thing is that it was a pirate ship (Arr. *Anab.* 3, 2, 4, App. *Mith.* 92, Phot. *s.v.*), and a typical one (Theophr. *Char.* 25, 1), and could be classed with the little myoparones, which were certainly single banked (evidence Torr 119); it was a favourite for surprises (Diod. 19, 65, Polyæn. 4, 7, 4); and the latter passage also shews it was small, the object of Demetrius being to display the minimum of force. Pirates, whose heads depended on their speed, would not go in for fancy arrangements of oars.

²³ The word occurs in the active sense once, in a chorus (Eur. *I. T.* 407), *δίκροτοισι κώπαις*, of the Argo, (a traditional single-banked ship, Ap. Rhod. 1, 394 *seq.*), where it refers to the beat of the oars on either side of the ship. This shews that in Euripides' time it cannot have been a technical term for the beat of two banks on the same side of the ship.

²⁴ The same causes which compelled the Venetians to divide the crew of a trireme into

3 squads and work as a rule in relays (Fincati p. 167) would have compelled the Greeks also to do this. Part of a crew did row alone, (Thuc. 3, 49; Polyæn. 5, 22, 4; Xen. *Hell.* 6, 2, 29); but these passages do not shew which part. If, however, when not in action, one squad only rowed at a time, as at Venice, it is explained how the Athenian horse-transporters, with 60 oars only, kept up with triremes.

²⁵ *i.e.*, when used as technical terms; for Thuc. 7, 65 (the Syracusans covered with hides *τὰς πρῶτας καὶ τῆς νεῶς ἄνω*) might refer to the upper works of the ship. As to *οὐκ ἐπὶ πολὺ ἔξω ἔχουσιν τοῦ ὕδατος*, the forward oars would of course suffer most in the bad water. But it may be that these triakontors, built for a river, were even lower in the water than usual, and anyhow they would be heavily laden. Some were lost going down from Patala.

²⁶ 'In the Odyssey *κατά* is the regular word for motion inwards, *ἀνά* for motion outwards;' Mr. J. L. Myres, *J.H.S.* xx. p. 140 *sq.* For later Greek, Mr. A. P. Oppé, *J.H.S.* xxiv. p. 225 *sq.* Mr. G. F. Hill kindly furnished me with these references. If the ship was generally entered from the stern, this would explain why *κάτω* should be fore and *ἄνω* aft; and at Athens anyhow she would be entered from the stern, if launched bow first; see Prof. E. A. Gardner, *Ancient Athens*, p. 553. This is also borne out by the ordinary term for 'to come forward,' *ἀναφέρειν τὴν κώπην*, which shows that *ἀνά* is motion toward the stern.

the sense required by the natural reading of the Greek,²⁷ and all the other evidence of Class (2) cited n. 14, except perhaps the one passage in Eustathius, which, as we have seen, must be treated as overruled. The conclusion reached under section *A* is thus strongly supported.

It is of course also possible that in some ships the forward squad sat, or once sat, rather lower on the whole than the after squad.²⁸ If this were so, the thranite oars would on the whole be rather the longest; and if the Athenian trireme resembled the Venetian triremes in Fig. 1, this may perhaps explain the statement in the Athenian lists that of some condemned thranite oars ten were serviceable for the zugites.³⁰ Once *κάτω* had come to mean 'forward,' the term would remain, even if in historical times the difference was slight, or even non-existent; how many centuries have passed since 'forecastle' or 'starboard' had any real meaning?

But to return to *δίκροτος*. When Hesychius says that a *διήρης ναῦς* was also called *δίκροτος*, is he wrong? Or is the more accurate Pollux (1, 82) wrong in treating *διήρης* and *δίκροτος* as separate ships? I think both are right. I will assume here for a moment the result arrived at in section *E*, that (subject to the meaning of *δίκροτος*) there is no evidence for the use of biremes until well on in the first century B.C.; the question then is, is there any passage in which *δίκροτος* must mean a breme? I think there can be no doubt that it means something different from and larger than a *μονήρης*, but smaller than a trireme, in App. *Mith.* 92 (see n. 22); and it will be fairest therefore to assume that to Appian generally *δίκροτος*

²⁷ Incidentally, this may suggest that Schol. *Frogs* 1074 represents a genuine tradition, i.e., one descended from a time when men knew the technical meaning of *κάτω*; for of course I do not suppose that the Scholiast knew this, any more than Eustathius, and all that I can attempt to shew is what the word meant to Arrian, or rather to Ptolemy.

²⁸ Bauer, *Neue Philol. Rundschau* 1895, p. 265, 'in Schräg vom Hinterschiff zum Vorschiff abfallender Linie angeordneten Ruderpfosten,' which may well be right. It is clearly shewn in the Venetian triremes in Fig. 1. See Aesch. *Agam.* 1617, and n. 80.

²⁹ The inclination of the *παρεξέσπια* to the long axis of the ship (n. 118) would furnish another explanation. The longest oars of the tessarakonteres were thranite oars, as the reference to the lead shows (Ath. 203 f); but as we have no idea how she was arranged, it is useless either suggesting explanations of this or drawing deductions from it as to triremes. All her thranite oars were not of the same length.

³⁰ *C.I.A.* vol. 2 part 2, 791 l. 56—*θρανιτίδων τούτων ἀποφαίνει ὁ δοκιμαστής ζυγίας* Δ. If the number of the *θρανίτιδες* that were

ἀδόκιμοι were extant, we might have something to go on as to the relative lengths; for as most oars go at the leather, or point of contact, then if only a few could be used as *ζυγία* we should know that any theory (like Assmann's explanation of the Lenormant relief) which made the zugite oars less than two-thirds of the length of the thranite, was, on this ground alone, untenable. The higher pay of the thranites probably had nothing to do with the length of the oar, (that is a Scholiast's guess), but was merely one sign of the greater consideration they enjoyed; and the primary reason no doubt (apart from any question of their more probably being burgesses) was that it depended largely on them, as the stern oars, whether the boat was 'together' and kept her pace. Great importance was attached to the manning of the stern benches in a mediaeval galley, as Jurien de la Gravière shews. The Athenian lists do not really prove anything at all as to the relative length of the oars, as we do not know why those ten were condemned; and we have no right to make them mean that all thranite oars were longer than all zugite oars, still less that they were much longer.

means bireme, which (incidentally) takes us back to the first Mithridatic war (*Mith.* 17). How then came a word, which at the end of the fourth century was applied to a triakontor, to mean a bireme?

The first standard warship was the pentekontor, invented in 704 B.C.,³¹ from which was afterwards evolved the trireme. By the time of Demosthenes the pentekontor was no longer in regular use,³² shewing that the trireme did its work and did it better. But the lighter triakontor was in full use throughout the fourth century³³; and by the end of this century we find frequent mention of another light ship of a different type, the first³⁴ of many borrowings from pirates, the hemiolia,³⁵ from which perhaps was again evolved a sort of light or abnormal trireme, the trihemiolia.³⁶ The hemiolia and triakontor, however, run side by side as light warships, shewing that neither could do the other's work; presumably the speedier hemiolia could not ram. Philip V. introduced another light pirate ship, the Illyrian lembos,³⁷ which combined with great speed the power of ramming, and obviously effected something like a revolution in naval warfare (battle of Chios, 201 B.C.). The last mention, I think, of the triakontor in history is in the treaty between Rome and Antiochus III., 188 B.C.³⁸ The lembos then, doing the triakontor's work and doing it better, presumably tended to drive out the triakontor; and perhaps we shall not be far wrong if we guess that some one thereupon took a leaf out of Philip's book,³⁹ 'double-banked' his triakontors, and so evolved the bireme,⁴⁰ which would still be as much a *ναὺς δίκροτος* as the original triakontor had been, possessing two squads only. As the triakontor vanished, the term *δίκροτος* remained adhering (without ambiguity) to the bireme; and probably by the time that Appian

³¹ See Kroker, *Die Dipykton-vasen* (*Jahrb.* 1886), with whose account (p. 106 seq.) of the first evolution of the warship I agree, as against Pernice's criticism in *Ath. Mitt.* 17 (1892), p. 306.

³² It does not occur in the Athenian lists, and plays no part in battles again. I do not mean it was not built at all; Mithridates *e.g.* had a few, and see Polyb. 1, 20, 14 (the Italiot states), 25, 7, 1 (Egypt).

³³ Athenian lists; Arrian *l.c.* and 7, 19; Polyæn. 3, 9, 63; etc.

³⁴ If indeed the triakontor was not originally a pirate, Thuc. 4, 9.

³⁵ See n. 22.

³⁶ See n. 11.

³⁷ Demetrius had lemboi at the siege of Rhodes (Diod. 20, 85), but we do not hear of them in action (if Diodorus be correct neither he nor Ptolemy put *μονήρεις* into line at Salamis), and so cannot say if they were the Illyrian lemboi or not. Polyb. 1, 53, 9, and 3, 46, 5 (Hannibal crossing the Rhone) add nothing, and earlier mentions of lemboi refer to ship's boats. Polybius is clear as to Philip's

fleet of lemboi being almost a new thing (5, 109, *σχεδὸν πρῶτος τῶν ἐν Μακεδονίᾳ βασιλείων*) and as to his tactics at the battle of Chios being new. We may conclude that if he was not actually the first to introduce the Illyrian lembos he was the first to perceive its possibilities and to use it in a fleet action.

³⁸ Polyb. 21, 45 *μηκέτι ἐχέτω πλὴν εἰ καταφράκτων· μηδὲ τριακοντάκωπον ἐχέτω ἐλαυνόμενον κ.τ.λ.* Livy 38, 38 has run the two together (*neve plures quam decem naves actuarias nulla quarum plus quam trigiuta remis agatur habeto*), while App. *Syr.* 39 mentions cataphracts only.

³⁹ See post, n. 94 as to Philip's 'lemboi biremes,' and 'double-banking.'

⁴⁰ Precisely the 'galeotta' of Furtenbach. No doubt someone experimented with biremes before triremes were invented. But these experiments remained without effect (witness the silence of Herodotus, Thucydides, and the Athenian lists, and indeed of all writers prior to Caesar) and have nothing to do with the biremes known to history, which appear first in the 1st century B.C. See under *E.*

and Arrian wrote the fact that the word had once applied to a triakontor had really been forgotten, and would have been lost, had not Arrian fortunately simply copied down Ptolemy. The above explanation is of course guesswork, but (I think) reasonable and consistent guesswork.⁴¹

As to *μονόκροτος* and *τρίκροτος*. These words, unlike *δίκροτος*, really were ambiguous, and therefore little used. Many ships were *μονόκροτοι*—not divided into squads; and apart from Xen. *Hell.* 2, 1, 18,⁴² the word is found only once.⁴³ Similarly, *τρίκροτος* would apply, not only to triremes, but to all the larger polyereis; the word occurs thrice only, in Aristeides, Niketas, and Clement of Alexandria; they throw no light on its meaning.

C.

I have failed to trace either the genesis of, or any scrap of evidence that will support, the dogma that among Greeks and Romans, at all times and in all places, one man rowed one oar—a dogma that is responsible for three quarters of the nonsense written about the larger polyereis. Many writers are content to refer to the evidence as 'well-known,' generally a sign that there is not any; as given by Assmann and Luebeck, the proofs are Thuc. 2, 93; Polyæn. 3, 9, 63; Leo *Tactica* 19, 8; all the monuments.

Thuc. 2, 93⁴⁴ is conclusive evidence for this, and for this only, that in

⁴¹ It may be objected that the bireme of Octavian's time was a 'Liburnian.' Biremes are mentioned in history earlier than Liburnians, which is all I require; but it is as well to be clear about the Liburnian. In origin, it was another of the light swift pirate-craft of the Adriatic (App. *Ill.* 3), if indeed it was not the lembos under another name; and the fact that under the Empire the Liburnian was built, first as a bireme (App. *Ill.* 3, Lucan 3, 534—note Lucan's 'crevisse,' it had *grown*) and later as a trireme, etc. (Veget. 4, 37), which nobody doubts, only shews that there were biremes of two different builds running parallel, the Liburnian bireme evolved from a Liburnian and the dicrotos bireme evolved from a triakontor (just as earlier there were the trireme and the trihemiolia); see *C.I.L.* 5, 1956 which mentions a 'bicrōta' called Mars and a 'Liburna' called Clupeus. When Appian (*Ill.* 3) says that in his time light *δίκροτα* were called Liburnians he shews, either that the two builds had become confounded, or (more probably) that he was ignorant of the process by which the *δίκροτος* bireme had been evolved, and that for him *δίκροτον* was simply 'bireme.'

⁴² This passage is a good instance of one which explains equally well on any theory and is useless to cite. Other good instances are Polyæn. 5, 22, 4 and the drowning thalamites

of App. *b.c.* 5, 107.

⁴³ Strabo 7, 325. ἀνέθηκε Καῖσαρ τὴν δεκανατῶν ἀκροθίνιον, ἀπὸ μονοκρότου μέχρι δεκῆρους. He uses the word to mark the fact that the trophy began, not only with a *μονήρης*, but with the smallest kind of *μονήρης*.

⁴⁴ λαβόντα τῶν ναυτῶν ἑκαστον τὴν κώπην κ.τ.λ. Bauer alone has put this correctly. As regards triremes, the passage is conclusive as against Weber (three men to an oar) who has to mistranslate it, and Serre (three banks, but in action only the top bank rowed by three men to an oar), for then Brasidas would not have troubled to take the other oars with him on a mere raid. The large number of oars for a trireme given in the Athenian lists also certainly presupposes one man to an oar. Weber has to say a trireme carried two spare sets, which (apart from the question of weight) is improbable, seeing that the account of battle after battle assumes that a ship with a crippled *παρὰς* is out of action. The spare oar question is not, however, easy; see e.g. the Hippias (*C.I.A.* vol. 2 part 2, 802 c. 6) which is said to have a *παρὰς δόκιμος* (not, however, ἐντελής δόκιμος) though five oars are broken. Probably Assman's solution is the best (reviewing Schmidt in *Berl. Phil. Woch.* 1900, No. 43); the *πρόπτερ* oars were deck sweeps, carried for use in a ship left crippled. I may add that,

the triremes of the Greek states at the time of the Peloponnesian war one man rowed one oar. One is ashamed to have to state anything so elementary.

Polyaen. 3, 9, 63 refers explicitly to triakontors and to no other ships; and Leo *Tact.* 19, 8 refers explicitly to the Byzantine dromones of Leo's own time and to no other ships. Neither passage has the least bearing on the question: as Luebeck at least saw.

As to the monuments. It sounds well to say that no monument shews more than one man to an oar, provided that the hearer be not acquainted with the scantiness, the inadequacy, and the obscurity of the monumental evidence. As every monument that shews rowers is called a bireme or a trireme, this obviously has no bearing on the question of the larger polyereis, of which we are not supposed to possess any representation at all.⁴⁵

But although there is not one bit of evidence for this dogma, which should long ago have been relegated to the limbo of things forgotten, there is evidence from the Athenian lists which proves that, at Athens in the time of Demosthenes, the oars of a trireme could form part of the *ταρῥός* of a quadrireme and the oars of a quadrireme part of the *ταρῥός* of a quinquereme:⁴⁶ Böckh called attention to this. Now quadriremes are common enough in the later lists, and remained in use at any rate for some time, for there were 30 Athenian quadriremes in Demetrius' fleet at Salamis (306 B.C.), and as they were posted on the left wing, on which Demetrius had massed his strength, they were presumably good efficient ships. We therefore get to this, that toward the end of the fourth century an Athenian quadrireme had one man to one oar, and similar quinqueremes were being experimented with.⁴⁷ But though not in use at Athens, quinqueremes had been known and used at Syracuse since Dionysius I.;⁴⁸ and therefore perhaps we may, or ought to, say generally of the quadriremes and quinqueremes of the fourth century B.C. that they had one man to one oar and were, in fact, enlarged from, and similar to, triremes,⁴⁹ as shewn by the transference of equipment generally (*σκεύη*) from one to the other at Athens. However, beyond the fact that the Athenian quadriremes were efficient, all the evidence we possess that throws any light on the nature of any of the larger polyereis is later than the fourth century,⁵⁰ or rather is not earlier than the building by

with a *παρεξίρεσις* half carried away, no spare oars but deck sweeps would (on the view I take of a trireme) have been of much use. Possibly however a trireme rowed 25 groups of 3 oars each side, and carried some half dozen spare oars of each class.

⁴⁵ And if we had, it would be a cataphract, and so could not shew any rowers.

⁴⁶ *C. I. A.* vol. 2 part 2, 812 a 35: οὐ[το]ς τῆμ μὲν τετρήρη ἀποδέδωκεν τὰ δὲ σκεύη ὀφείλει διὰ τὸ [ἐπὶ] πεντήρη κατασταθῆναι. The *σκεύη* here include the *ταρῥός* which had been previously mentioned. 812 c 143 *seq.* Ἡδεῖα. . . . [οὐ]τος τὴν τρήρη ἀποδέδωκεν διὰ τὸ

ἐπὶ τετρήρη καθεστηκέναι [τὰ δὲ σκεύη] ὀφείλει (here follow the *συντριήραρχοι*) *σκεύη* ἔχουσι ξύλ[ινα ἐντελῆ]. . . There is another passage to the same effect, and the filling up of the lacunae is quite certain. Incidentally, this disposes of every reconstruction of a trireme which cannot be expanded into a quinquereme.

⁴⁷ Rarely mentioned, and only in the last extant list.

⁴⁸ Diod. 14, 41.

⁴⁹ Here we undoubtedly meet Assmann's *breitpolyereis*.

⁵⁰ I shall find it convenient to talk of ships of the fourth century, prior to Antigonus' fleet,

Antigonus and Demetrius of the fleet which afterwards fought victoriously at Salamis. Meanwhile there is no evidence for any ship larger than a hexeres⁵¹ prior to this fleet of Antigonus'; and I fancy that even the mention of hexereis is probably an anticipation of events.

D.

Taking the battle of Salamis (306 B.C.) for the moment as a convenient mark of time, what evidence can we get as to the larger polyereis later than this battle? So far as we have gone, we are at liberty to suppose more than one man to one oar in the larger polyereis in the last three centuries B.C., subject to this, that, as in a fourth century πεντήρης one man rowed one oar, we must not suppose that the same word at a later time had a different meaning unless evidence appears to that effect. I give in this section such evidence as I know of as to the larger polyereis in the last three centuries B.C., the effect of it being to make it probable that they were galleys a scaloccio of some kind with more than one man to an oar, and to make it, I think, reasonably certain that the accepted theory is quite at variance with the facts.⁵²

(a) Some men in some ships stood at the oar, and were therefore rowing oars a scaloccio. It was the chief merit of Weber's book to call attention to the passage in Appian that proves this. When the sea got up (he says), Salvidienus' inexperienced crews could neither *keep their feet* nor 'come forward.'⁵³ Note that Appian is not caring about informing the reader whether they stood or sat; he merely uses ἐστῶτες as an illustration, by the way, of how bad the tide was; he refers to it as to a well-known thing. Such a reference can hardly ever be anything but correct. Unfortunately, the

simply as ships of the fourth century. It will not create any confusion. For our purpose the third century begins with Salamis.

⁵¹ Aelian *V.H.* 6, 12: Dionysius II. had a fleet of 400 ships, hexereis and quinqueremes; this is of course impossible, and it must mean 'including hexereis and quinqueremes'; see Diod. 16, 19. Even so, the statement as to hexereis is extremely improbable, seeing that Alexander never had anything larger than a quinquereme. Very possibly Dionysius II. had built one hexeres on the fourth century system (whatever it was), as a 'royal ship.' The statement of Pliny *N.H.* 7, 56, that Alexander invented the dekeres, is valueless; see Luebeck 1, 17 n. 6 and Droysen 272 n. 3, who give the evidence as to Alexander's fleets. It is precisely what *would* get stated about Alexander, and is on a level with Curt. 10, 1, 19, the 700 heptereis carried over in sections to the Euphrates; this last is refuted, were refutation necessary, by Arr. *Anab.* 7, 19, who gives the

correct version (from Aristobulus).

⁵² Many writers have *assumed*, on the ground of practical necessity, that in the larger polyereis more than one man rowed one oar; but that is another matter. Serre and Weber try to shew that Ap. Rhod. 1, 396 means two men to an oar; but there is no foundation whatever for this. The passage, a straight-forward one, had already been correctly explained by Cartault.—Possibly the Delos ship of Paus. 1, 29, 1 would be in point, if one knew what the passage meant; but I cannot translate it, and Frazer's translation 'decked for nine banks of oars' conveys no meaning to me. Pausanias had of course heard of higher values, and therefore the ship was abnormal in some way; νικησάντα does not mean 'larger than' but 'more curious than.'

⁵³ *b.c.* 4, 85 (battle between Sextus Pompey and Salvidienus); οὔτε ἐστῶτες βεβαίως ὑπὸ ἀνέλας, οὔτε τὰς κώπας ἔτι ἀναφέρειν δύναμενοι.

size of Salvidienus' ships is not stated, though they are said to be larger and heavier than those of Sextus: we must therefore consider the alternatives, taking two things as fixed points, *viz.*, that for serious work no man ever stood at an oar if he could possibly sit, and that five men to one oar cannot all sit through the stroke.

First, can the ships in question be merely triremes?

Fincati gives an account of the Venetian *zenzile* triremes, three men on a bench rowing three oars; extremely long oars, with leaded handles; he gives the lengths as 32, 30½, and 29 feet, and proves these extraordinary figures from Venetian arsenal-lists. Obviously, with such oars the stroke must have been a slow one; and Fincati states (p. 167) that they rowed a stroke called *monta e casca*, rise and fall.⁵⁴ Were then the ships of Salvidienus in question triremes, rowing the stroke called rise and fall?

This can I think be disproved. The oars of a trireme, whatever their exact length, were certainly very short compared to the Venetian, perhaps not more than half the length;⁵⁵ and there would be no point in rowing so cumbersome a stroke, for with the shorter oars the crew of a trireme could certainly have rowed sitting. That they *did* row sitting is clear from this, that on occasion they could row a really fast stroke,⁵⁶ which would not be possible except sitting. And if they ever could and did row sitting they would certainly do so when it was rough. What applies to triremes applies a fortiori to smaller ships.

Suppose then that Salvidienus' ships were quinqueremes on the model of the fourth century Athenian quinquereme. Then, taking two other fixed points, *viz.*, that three of the ordines were identical with those of a trireme, and the oars in the other two only slightly longer,⁵⁷ we again get the fact that the men could have, and therefore would have, rowed sitting, or at most in the case of the longer oars with some such slight lift from the seat as some men are apt to give in the first stroke of a race. This might conceiv-

⁵⁴ 'Vogue dans laquelle la force sur l'aviron est produite presque tout entière par le poids du rameur, qui, monté debout sur la pédague ou sur le banc qui précède, se jette en arrière, et, tirant à lui son aviron, va tomber assis sur son propre banc.' The lead may have been used to meet the difficulty of the oars being of different proportionate lengths inboard. How this was met in a Greek trireme does not appear; the only actual reference to lead is with regard to the thranite oars of the *τεσσαράκονθρης*.

⁵⁵ The length of the *περίεσσι* oars, 4.4 m., is the only one actually known, but this supplies a kind of limit. Schmidt has an interesting attempt to work out the measurement from the data as to the Athos canal in Herodotus and Demetrius of Skepsis; he makes the longest

oars in a trireme 3.3 m. outboard.

⁵⁶ There are of course a great many references to spurling, and the common name for it, *βοθιδεῖν*, implies a fast enough stroke to make a good deal of splashing. The celebrated feat of an Athenian trireme, which swung round a merchantman and rammed her pursuer (Thuc. 2, 91) implies a quick lively stroke and a power of backing water on one side only quickly and forcibly. And the fact that a crew could only last a short time in action (*e.g.*, Polyæn. 3, 10, 12, Diod. 13, 77, Frontinus 2, 5, 47) conclusively implies a fast stroke. Chabrias, training rowers for a trireme, trained them sitting; Polyæn. 3, 11, 7: and *cf.* Aristophanes' reference to 'that which fought at Salamis.'

⁵⁷ See n. 110.

ably satisfy the passage in Lucan *Phars.* 3, 543, 'in transtra cadunt et remis pectora pulsant,' but it will not satisfy Appian's *ἐστῶτες*.

If then the ships were quinqueremes or higher values *differing* from the quinqueremes of the fourth century—and no other alternative now remains—the only reasonably probable explanation of Appian is that enough men rowed one oar for some at least to be on their feet some part of the stroke—if not throughout it—*i.e.*, five men to an oar.⁵⁸ I regret the conclusion, as it involves saying that *πεντήρης* meant one thing in the fourth century and another in the first; but we have seen that this was certainly the case with *δίκροτος*, and we shall find other reasons for supposing it to be correct. Incidentally, Appian is conclusive, I think, against a theory such as that a quinquereme was a three-banked ship with oars rowed by 2, 2, and 1 men respectively; for 2 men can sit to any oar.

(b) The larger polyereis were not only of very shallow draught,⁵⁹ but low in the water also. The shallow draught is now generally admitted; the lowness in the water (a necessary consequence, by the way), requires consideration.

Polyb. 2, 10. The Illyrians, fighting with the Achaeans, lashed their lembi together by fours and let the Achaeans ram. As soon as an Achaean ship was held fast by its ram the Illyrians leapt on her deck (*ἐπιπηδῶντες ἐπὶ τὰ καταστρώματα*) and in this manner captured four quadriremes and sunk a quinquereme. The quinquereme then was but little higher than the small light lembi.⁶⁰

Polyb. 16, 4 (battle of Chios again). It would have gone hard with the Macedonians had they not stationed lembi among their cataphracts: as soon as the battle became a *mêlée*, and the Rhodians could no longer manœuvre, the lembi attacked them, even meeting them bow to bow: this the Rhodians met in a workman-like way.⁶¹ I shall come to this

⁵⁸ There is a fine picture of a mediaeval quinquereme, with 5 men to an oar, on Pl. VII. of Furtenbach's *Architectura Navalis*, 1629; with a huge outrigger, and the oarsmen on their feet. A good description of such a quinquereme in Bigge, *Der Kampf um Candia in den Jahren 1667-1669* (Kriegsgeschichtliche Einzelschriften, Heft 26, 1899), p. 130: the men worked in three relays, as in a trireme. I owe the reference to these writers to the kindness of Mr. W. C. F. Anderson. For the scaloccio galleys generally, see Admiral Jurien de la Gravière, *Les derniers jours de la marine à rames*, 1885; the different strokes in use (none rowed sitting) are described p. 231 *seq.*, the best of commentaries on Appian and on Lucan, *Phars.* 3, 543.

⁵⁹ Quinqueremes run ashore and the crews depart, Polyb. 1, 51; 3, 96; etc. Attalus' royal flagship at the battle of Chios (size not given, but following the usual Hellenistic practice [see too Beloch, *Gr. Gesch.* iii. pt. 2,

p. 428 n. 2] it would be the largest he had, and he had quinqueremes) runs ashore and the king and his crew *departed* (*ἀπεχώρησε*); Philip tows her off uninjured (Polyb. 16, 6 and 7). Diodorus 20, 47, Demetrius sails to Cyprus and draws his ships ashore and surrounds them with a palisade and ditch; he had heptereis and hexereis, and no preparation made for drawing them up. Frontinus 1, 5, 6, Duilius' ships (quinqueremes anyhow) cross a boom at Syracuse. Ath. 204 c, the dock of the tesserakonteres was only four cubits deep. Livy 30, 25 is not against this; the quinquereme there was damaged because driven ashore *at full speed*.

⁶⁰ Lembos small and cannot have had more than one bank: Livy 34, 35, and evidence collected by Torr *s.v.*

⁶¹ *ἐμπικτόντων αὐτοῖς τῶν λέμβων ποτὲ μὲν εἰς τοὺς ταρσοὺς . . . ποτὲ δὲ πάλιν εἰς τὰς πρῆρας . . . , κατὰ δὲ τὰς ἀντιπρῆρους συμπτώσεις ἐποιοῦν* (the Rhodians) *τι τεχνικόν*.

presently. Polybius is speaking here of the Rhodian wing. The Rhodians and Attalus together had in action three triremes, nine trihemioliai, and sixty-five cataphracts, by which larger ships than triremes are here meant; and 16, 5, shews plainly that the Rhodian ships attacked by the lembos were, or included, quinqueremes. A lembos then could meet a quinquereme bows on, and the two must therefore have been of approximately equal height. On the accepted theory it would be like a destroyer trying to ram a cruiser bow to bow.

Caesar *b.g.*, 3, 14. The sterns of the ships of the Veneti (which were real ships, not galleys, though shallow bottomed) were higher than the tops of the turrets on Caesar's galleys. The size of Caesar's galleys is not given, but as they carried turrets they cannot have been small ones.

Plut. *Ant.* 67. Eurykles in a Liburnian pursues Antony, then on Cleopatra's flagship, converses with him, and threatens him with a spear. Plutarch evidently conceived of the heights as not unequal, especially as Eurykles then attacks the second Egyptian flagship and spins it round like a top (*περιεπρόμβησε*). Add perhaps Diod. 20, 50 (battle of Salamis in Cyprus): those on deck spear their enemies in the water; and Val. Max. 1, 8, b, 11: a rower, engaged in baling out a Tyrian hexeres, was swept overboard by a wave. As they had no pumps,⁶² he must have been baling from the deck with a bucket; presumably she was very shallow.

Now as to the evidence generally quoted for the *height* of the larger polyereis, *viz.*: Livy 30, 25, Cic. *Verr.* 2, 5, 34, Orosius 6, 19, Dio Cass. 50, 33; (I know of no other; no one, I think, has thought it advisable to cite Vergil on Actium).

Livy 30, 25. Three Carthaginian quadriremes attack a Roman quinquereme; she was too speedy to ram, and the men in their armour could not board her as she was the taller ship.⁶³ The height here is of course only relative to a quadrireme; and as you could board a quinquereme from a lembos you could of course do so from a quadrireme. Unless the point is the word *armati*, the most probable explanation is, that she had her turrets on board.⁶⁴ Anyhow, the passage affords no evidence for the supposed considerable *actual* height of a quinquereme.

Cic. *Verr.* 2, 5, 34. Cleomenes ran away from the pirates, and the

⁶² One of the wonders of Hiero's ship was the water-screw invented for her by Archimedes, Ath. 208 f.

⁶³ Sed neque rostro ferire celeritate subterlabentem poterant neque transilire armati ex humilioribus in altiore navem.

⁶⁴ First mention of turrets, battle of Chios (201 B.C.) Polyb. 16, 3, *πυργούχων* (unless *πυροούχων* be the correct reading). The best commentary on Livy here is the battles of Mylae and Naulochos in App. *b.c.* 5. At Mylae, though some of Sextus' ships carried towers, they were on the whole much lower

and lighter than Agrippa's; and the point of Sextus' epigram (108), that he had been storming forts, not fighting ships, was Agrippa's turrets. He gave orders *τι προσθήσειν ἐς τὸ τῶν νεῶν ὕψος*, and by the *height* of the ships turrets are clearly referred to, for at Naulochos all his ships carried turrets, and could only be distinguished from Agrippa's by the war-paint (121). This seems to shew that altiore is quite satisfied by turrets. The accounts of Actium shew the difficulty of boarding ships carrying turrets.

pleader's case is to magnify his force so as to emphasise his cowardice. His quadrireme, the only *navis constrata* in the squadron, would, if he had joined battle, have appeared as big as a town among the pirates' myoparones. There is of course nothing in this bit of rhetoric about *urbis instar* the moment the context is read.

Orosius 6, 19⁶⁵ and Dio C. 50, 33. The Orosius passage was taken by Assmann to prove that the height of a *dekeres* (*dekereis* being the largest ships in Antony's fleet) was 10 feet. What Orosius says is that Antony's *dekereis* were *actually* 10 feet high; which is quite another thing. Antony's ships created the impression of being the largest ever seen, as appears in every account of the battle; according to Dio Cass. 50, 23, Antony, being aware that Octavian had crushed Sextus Pompey by sheer size and weight,⁶⁶ resolved so to crush Octavian, and outbuilt him; a good deal of the speech put into Antony's mouth before the battle by Dio (50, 18) is taken up with boasting of the size and height of his ships and their towers, on the disadvantages of which Octavian in his turn expatiates (50, 28). If these monster *dekereis* were 10 feet high, what was the height of an ordinary *dekeres*, and how low in the water was an ordinary quinquereme? Supposing Orosius to be correct, a sentence more decisive against the accepted theory was never written. Then Dio 50, 33; when the fleet was broken up, and each of Antony's ships was surrounded, it was like forts or islands being besieged—a consistent part of the picture, but implying nothing further as to height; the reference in *τείχεσι* is to the turrets,⁶⁷ to which also Orosius' measurement might possibly refer.

(c) A warship, of shallow draught and low freeboard, very long, was light and crank.⁶⁸ Livy 36, 44; two of Polyxenidas' ships attack Livius' flagship; he wishes to throw grapnels, and bids his men steady their ship for the encounter by keeping their oars in the water.⁶⁹ Any rowing man will see at once what kind of a 'ship' this implies. Plut. *Ant.* 67, before cited: a Liburnian spins the Egyptian flagship⁷⁰ round like a top. Demetrius' heptereis are drawn ashore anywhere; and Archimedes' grapnel could lift a

⁶⁵ *Classis Antonii centumseptuaginta navium fuit quantum numero cedens tantum magnitudine praecellens. Nam decem pedum altitudine a mari aberant.*

⁶⁶ Battles of Mylae and Naulochos in App. *b.c.* 5; and see n. 64; Dio Cass. 48, 47, 4 and 49, 1, 2: the evidence is overwhelming that for a few years there was a great race in building; not only as regards height, but more especially in weight and thickness, see Plut. *Ant.* 65, 66. I do not know why it is believed that Octavian had only light ships at Actium. He had the fleet with which he had crushed Sextus; up to *hexereis*, Florus 2, 21 (4, 11). Plut. *Ant.* 62 is responsible for the other view; probably adopted to rub in the moral.

⁶⁷ Whether Sextus in fact ever spoke of *τειχομαχῆσαι* or not, it became a commonplace; see *τειχομαχία* in Plut. *Ant.* 66.

⁶⁸ Polyæn. 3, 11, 13 (if the rowers sprang up in a hurry they might upset the ship), presumably refers to a trireme; nor do I lay stress on Lucan, *Phars.* 3, 665: if she took in drowning men she might turn over.

⁶⁹ *quum inferrentur, demittere in aquam remos ab utroque latere remiges stabiliendae navis causa jussit.* App. *Syr.* 22, gives 3 Syrian ships, not 2, and says that it was they who tried to grapple Livius.

⁷⁰ Size not given, but the flagship of any Hellenistic monarch was always the largest obtainable.

quinquereme half out of the water. Arr. *Anab.* 7, 9, Alexander has quinqueremes carried in sections from the Mediterranean to the Euphrates.

(d) The arrangement of a quinquereme was simple; there was none of the complexity of structure that five superposed banks would involve.⁷¹ At the battle of Chios the Rhodians met in a workmanlike manner the lembos which rammed them bow to bow: they sunk their own rams under water, and so, while struck above the waterline themselves, they struck their enemy beneath it.⁷² Polybius is explicit that they did this *during* the fight; besides, they cannot have gone into battle with their hulls weighted down, as it is stated that at the beginning of the action their pace enabled them to row round their opponents. The only way a ship can lower its *whole* freeboard during action is by taking in water, as was done *e.g.* by the Huascar when bombarding Callao; this is out of the question, as quinqueremes cannot have had double bottoms, and also had no pumps. They lowered their rams then by shifting ballast forward, either live⁷³ or dead;⁷⁴ whence it follows that the system of oars was such that, with the bow depressed and the stern raised, the ship could still be rowed enough to keep her stem on to a speedy enemy. How this could be done in a boat having five superposed banks is incomprehensible; and any one who thinks that it could ought to work it out and demonstrate it. It implies some system in which, on the spur of the moment, changes of level and angle can be met; and this certainly implies among other things that all the oars were a reasonable height above the normal waterline, a state of facts demanded also, not only by common sense, but by the evidence that exists of changes in the waterline.⁷⁵ On the accepted theory, the lowest portholes forward of

⁷¹ This is presupposed by the pace at which a fleet could be built; for which there is plenty of evidence (no doubt sometimes exaggerated) beside the first Punic war. Elaborate arrangements for building were not required; Dio Cass. 48, 49, Octavian built ships *ἐν πάσῃ τῇ παραθαλασσίῳ Ἰταλίᾳ*; and no doubt the building of the *Argo* in Ap. Rhod. 1, 363 *seq.* is copied from current Egyptian practice.

⁷² n. 61 (continues) *αὐτοὶ μὲν γὰρ ἔμπροσθα τὰ σκάφη ποιοῦντες ἐξάλους ἐλάμβανον τὰς πληγὰς, τοῖς δὲ πολεμίοις ὕψαλα τὰ τραύματα διδόντες ἀβοηθήτους ἐσκεύαζον τὰς πληγὰς.*

⁷³ Like a modern racing yacht. See Frontinus 1, 5, 6; Duilius, to get his ships (including presumably quinqueremes) over the boom at Syracuse, shifts the troops aft, thus raising his bows, and goes at the boom at full speed, shifting the troops forward again at the critical moment. If this be true, a ship with bow raised and stern depressed, *i.e.* with every angle altered, could still get on a good deal of pace. It has, I understand, been demonstrated that a torpedo boat rushing an

ordinary floating boom at full speed may be expected to 'jump' it without doing herself any serious injury.

⁷⁴ Cf. Arr. *Anab.* 2, 19. If this be so, it implies that the ballast was easily got at during action.

⁷⁵ Those who speak of a row of portholes of 10 inches (.25 m.) (Assmann) or any such height above the (normal) waterline cannot really have thought what this would mean. Leaving practical considerations aside, the waterline was no more a constant quantity then than now. Polyb. 1, 60-62, the Carthaginian ships were much hampered by being loaded down with corn and stores which Hanno had trusted to put ashore before engaging. Diod. 20, 49 and 83, Demetrius mounts on the prows of his ships great catapults (*τοὺς τρισπιθάρμους τῶν δέμβελων*), and of course ballasted the sterns accordingly. So Duilius' *corvi*. App. b.c. 5, 121, Sextus Pompey's men throw over the turrets when escaping, shewing that they had been too low in the water. See too an appendix to Kromayer's article in *Philol.* for 1897, before

these Rhodian ships must have gone under water. This passage, in my opinion, certainly requires these quinqueremes to have been scaloccio galleys of 5 men to an oar, with the oars a reasonable height above the (normal) waterline.

(e) Finally there is Livy 28, 30.⁷⁶ Caught in some eddies, a Roman quinquereme nevertheless held her way better than the Carthaginian triremes, and was more manageable; and Livy's second reason no doubt is right; there was more *power* behind the oars, and the fact that she was normally slower than the triremes had become immaterial. A greater number of one man oars would not have helped in the eddies relatively to the triremes; the required meaning is more power to *each* oar. She must then have been a scaloccio galley.

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cited, on the great numbers of troops that could be carried at a pinch.—I do not give cases, like Marcellus' sambucæ before Syracuse, where the ships were not in action: though Marcellus' quinqueremes could still be rowed: Polyb. 8, 4(6).

⁷⁶ Quinqueremis Romana, seu pondere tenacior, seu pluribus remorum ordinibus scindentibus vortices, quum facilius regeretur, duas

triremes suppressit, etc. (For ordines remorum see under *E*). A little before, Livy had said she was slower than a trireme. Fincati p. 158: according to Nicolo Surian (1583) a quadrireme a scaloccio could beat a trireme a scaloccio but not a trireme a zenzile. It is just possible that these triremes were a scaloccio (n. 120) and owed their pace to the greater skill of the Carthaginians; but I think most improbable.

(*To be continued.*)

THE GREEK WARSHIP.

(Continued from page 156.)

II.

E.

THE evidence considered under *D* makes it, I think, impossible that the accepted theory can be true as regards the larger polyereis of the first three centuries B.C., which clearly were galleys a scaloccio of some sort. If what is put forward under *A* be true, the *reason* why the accepted theory was invented⁷⁷ and has been so largely believed disappears. Nevertheless, there is still room for evidence that will support the accepted theory as to triremes generally, the quadriremes and quinquereines of the fourth century, and the biremes of the first; and the theory may be true, even if the words *thranite*, *zugite*, and *thalamite* do refer to another arrangement.

For a trireme, said Cartault, the evidence is overwhelming. Unfortunately he omitted to mention what it was, and with the best will in the world I have been unable to discover it. Assmann (1610) relied solely on the monuments. Luebeck however gives Schol. on Aelian's *Tactica*, Schol. on *Frogs* 1074 (see under *A*), Arr. *Anab.* 6, 5, 2 (see under *B*), Pollux 1, 87 (see under *A*), and *Frogs* 1074. Let me add Livy 33, 30, Aesch. *Agam.* 1617, Luc. *Phars.* 3, 529 *seq.*

The Scholion on Aelian⁷⁸ (which I do not consider evidence) would be quite well satisfied by a galley, whether one a *zenzile* or one a *scaloccio*, in which the rows of rowers, taken as parallel to the long axis of the ship, should rise somewhat from the side of the ship toward the long axis. The phrase 'exstructi remigis' of Luc. *Phars.* 3, 530⁷⁹ may well refer to the same thing;

⁷⁷ According to Luebeck, its first modern supporter was Scaliger, relying on Schol. *Frogs*, 1074. But it existed when De Baif wrote in 1536.

⁷⁸ ἡ μονήρης καὶ διήρης καὶ ἐφεξῆς κατὰ τοὺς στίχους τοὺς κατὰ τὸ ὄψος ἐπ' ἀλλήλοις. Should anyone think I am unfair to the scholiasts, I would now refer to the chapters entitled 'The explaining of obsolete words' and 'The explaining of matters of fact' in Dr. Rutherford's recent volume *A Chapter in the History of*

Annotation.

⁷⁹ Validaeque triremes
Quasque quater surgens exstructi remigis
ordo
Commovet,
Celsior at cunctis Bruti praetoria puppis
Verberibus senis agitur molemque profundo
Invehit et summis longe petit aequora
remis.

while the 'summis...remis' of line 537, translated of course as 'thranite' oars, really answers to celsior two lines earlier; Brutus' hexeres was higher than the other ships and its oars were (necessarily) the highest and longest in the fleet. *Agam.* 1617⁸⁰ may only mean that the thalamite squad were, or had once been, somewhat nearer the water than the zugite squad, as is probable enough; unless *νεπτέρῃ* be a mere convention. *Frogs* 1074,⁸¹ taken literally, is of course dead against every version of the accepted theory, except Graser's: it no more suits Assmann than it does Bauer, Fincati, or Weber; moreover that *θαλίμαξ* = *θαλαμίτης* is mere Scholiast's guesswork. It is undoubtedly a bit of slang; Fincati refers to a similar expression in the Venetian dialect, and probably a professor of argot could parallel it in every language.

There remains Livy, 33, 30.⁸² Bauer (p. 462) and Weber have recognised the truth of the old view that the larger polyereis were named from rows of *rowers*; but the use of ordines remorum (or versus remorum) requires clearing up. It is obvious that, on *any* theory, it was a matter of indifference in a trireme, with one man to one oar, whether one said ordines remorum or ordines remigum. The Romans seem to have inclined to ordines remorum, the Greeks to *στοῖχοι ἐρετῶν*. When the galleys a scaloccio came in, ordines remorum ceased to be correct, but people went on using it; instances of such 'survivals' are common enough in English. This is strongly borne out by a passage in Florus, which has not been cited: 2, 21 (4, 11) Antony's ships at Actium had a senis in novenos *remorum* ordines, Octavian's a binis *remigum* in senos ordines. They were of course built on the same system; it was indifferent which phrase was used.⁸³ Ordines remorum then means only 'rows,' like ordines.

The only two phrases in all this that are of much use to an upholder of the accepted theory are Lucan's *exstructi remigis* and the Scholion on Aelian. One cannot build a theory on one epithet in a poet, and both phrases are, I think, easily explicable; but in case anyone should suggest that I find it convenient to say that the Scholion on Aelian (whatever it may mean) is not evidence, I would point out that, if I may cite scholia, there is one on Thuc. 7, 40, 5 which almost settles the question.⁸⁴

⁸⁰ σὺ ταῦτα φωνεῖς νεπτέρῃ προσήμενος
κώπη, κρατούντων τῶν ἐπὶ ζυγῇ δορός;

We have here a reference to a ship in which the zugite was the most important person, and so not a trireme; and as it is too early for a bireme, it bears out section B; it was a *μονήρης δίκροτος*. The importance of the zugite here came from his being the stern oar; see n. 30. Is it not possible however that the contrast is between oarsmen and fighting men, with a play upon *δορός*?

⁸¹ προσπαρθεῖν ἐς τὸ στόμα τῇ θαλάμακι. Anyone inclined to take this literally should read Jurien de la Gravière's remarks in *La Marine des Anciens*.

⁸² Quam sexdecim versus remorum agebant. A translation of *ἐκκαίδεκῆρης* in the corresponding passage in Polybius.

⁸³ This may help to explain Lucan's 'senis verberibus' (n. 79) which refers to *one* hexeres only, and should on the accepted theory be *sex verberibus*, if it were to refer to the beat of the six banks. It means 'with sixfold strokes' 'strokes worked (or made) by six (men) apiece.' Lucan's quadriremes have not four ordines, but a fourfold ordo.

⁸⁴ Thuc. 7, 40, 5 the Syracusans in boats *ἐς τοὺς ταρσοὺς ὑποκίπτοντες τῶν πολεμίων νεῶν*. Schol. *ὑποδυόμενοι ὑπὸ τοὺς ταρσοὺς*. If the schol. be right, as Bauer supposed, the accepted

Now as to the monuments. Breusing was the first to call for a thorough-going criticism. How badly it was (and is) wanted anyone can see who will refer to the astounding cases of misuse given by Mr. Torr in his preface (p. ix): and these are by no means the only instances.⁸⁵

Omitting coins and Trajan's column, we are supposed to have about 15 representations of biremes, 3 of triremes, and none of larger ships. Of the 'triremes,' only one really matters, the so-called Lenormant relief in the Acropolis Museum at Athens (possibly fourth century).⁸⁶ The 'biremes' fall into two groups, one belonging to the seventh and sixth centuries, the other to Hellenistic and Roman times. The most important of the latter group are the prow from Samothrace, in the Louvre (the only monument we can check by written evidence); the ship from the Temple of Fortune at Praeneste, in the Vatican Museum; and the Palazzo Spada and Ludovisi ships.

I do not count the river boats on Trajan's column. If any one cites them in proof of superposed banks, I may also cite them as proof that the upper oars were rowed over, or through, a fretwork railing, the lower without port-holes; that the rowers used their oars like Canadian canoe paddles,⁸⁷ had

theory is in a bad way, of course. But the schol. must be wrong. The same phrase in Dio Cass. 50, 32, 8 clearly means driving the ship across the oars so as to break them; he adds *καὶ τὰς κάρπας συναρπάσσοντες*; and warships could not go *under*. Cf. Polyb. 16, 4, 10 *ἐμπιπτόντων ἐς τοὺς τάρσους*.

⁸⁵ See Bauer 367 n. 1 on the so-called Malay bireme. See also two startling sections of triremes in Kopecky, *Die Altischen Trieren* (1890) plates 21 and 22, which he calls 'sehr beachtenswerthe Abbildungen alter Schiffe,' from Rondelet. 'Die erste (fig. 21) ist der Abdruck einer Medaille' etc. On turning up Rondelet (1820) I found, of course, they were Rondelet's own sections, the most worthless of guesswork; of fig. 21 Rondelet does not even pretend to figure, or refer to, any original, but merely labels it 'after a medal.'

⁸⁶ The two triremes in the Naples Museum, figs. 1676 and 1691 in Baumeister, the first from Pompeii and the other from Puteoli, are, I think, of no great value, as the top oars could hardly reach the water; but the way the oars are laid in threes, one actually upon the other, can be meant for nothing but three oars to a bench all issuing in a sheaf from one opening. The spirited Isis-temple ships, the only ones that give any idea of the general look of an ancient warship, are of no value for the 'problem.' I have not seen any representation of the Ulubad 'bireme'; but according to *B.C.H.* 12, 190 the oars (14 in number) are in groups of two, side

by side. If not a moneres, it would seem to add little to what can be learnt from the Palazzo Spada ship. Two recent discoveries, the ship on a metope of the Treasury of the Sicyonians at Delphi (see Assmann in *Jahrb.* 1905, p. 32), and a graffito on the wall of a tomb near Anfushi bay in Egypt, to which Mr. G. F. Hill kindly referred me (Dr. G. Botti in *Bull. de la Soc. Archéol. d'Alexandrie* (1902) p. 13 seq. and Admiral Blomfield *ib.* p. 37), do not bear on the problem of the oars; though the latter ship (called late Ptolemaic) is interesting as showing a further development of the *navis ignifera* used by the Rhodians in 190 B.C.

• ⁸⁷ Every oarsman will sympathise with Arenhold, *Die historische Entwicklung der Schiffstypen* (1891), when he says bluntly that every monument on which the oars 'ganz steil in's Wasser tauchen' is self-condemned. I would like to say the same of every similar reconstruction, and of every monument which shews an oarsman grasping the oar from underneath and with no possibility of getting his feet against anything. Mr. G. C. V. Holmes, *Ancient and Modern Ships* (1900), suggests that the monuments shew that the art of rowing was *not* understood till the Liburnian came in. But some mediaeval pictures also shew the oars at an absurd angle; e.g., C. A. Levi, *Navi Venete*, pls. 28 and 31; and it seems incredible that any people should row for centuries without discovering the proper angle for the oar to make with the water.

one hand *under* the handle, and sat bolt upright at the end of the stroke, and that a bireme had only eight oars aside, and a long list of other absurdities. The oars of the 'trireme,' in particular, are just plastered on anyhow; and it is an open boat. 'The design' says Mr. Torr 'makes little pretensions to accuracy.' It is high time that it vanished from the text books.

And I need hardly say that I do not count dal Pozzo's sketch, interesting as it is; for it is not known from what it is taken.⁸⁸

The prow from Samothrace. Assmann has been much praised for calling this a bireme. But, apart from the question whether the holes seen in the monument are really portholes,⁸⁹ if one assumes, as certainly Assmann does, and I think every one else, that the monument celebrates Demetrius' victory at Salamis, certain consequences seem to follow as matter of history, which must be considered.

In Alexander's lifetime quinqueremes were the highest value in use.⁹⁰ Somewhere between his death and the first Punic war the change of system that introduced the scaloccio galley (see section *D*) must have taken place:⁹¹ and as the higher values undoubtedly took their origin as fighting machines from the time when Antigonus the One-eyed resolved to build a fleet and command the sea (Diod. 19, 58 and 62), we shall not be far wrong in assuming that the change of system originated at the same time (though this is not perhaps very material), both alike being due to the inventive mechanical genius that made Demetrius famous as the Besieger of Cities. Demetrius with the new fleet, including seven heptereis and ten hexereis,⁹² beside smaller values, sailed for Cyprus, and met Ptolemy, who (naturally) had nothing larger than quinqueremes, at Salamis. Demetrius massed his strength, including all his heptereis and hexereis, on his left wing, which he led in person on a hepteres; and the picture given by Diodorus of Demetrius in

⁸⁸ Graser published it (*Arch. Zeit.* 1874 vol. 32, p. 71). It is now in the British Museum (Dept. of Gr. and Rom. Antiq.) It is certainly not a drawing of the Lenormant relief.

⁸⁹ Two slits in the *παρεξείρεσις*, on which Eins, *Das Rudern bei den Alten* (1896), has based what appears to be an attractive theory of the *διέκπλους*. I have not seen his book. Torr follows Graser in saying the holes are for ropes for an anchor: but if so they should be further forward. If they are not portholes, this hepteres had seven men to an oar, as the monument shews that no oars could be rowed anywhere except through, or resting on, the *παρεξείρεσις*.

⁹⁰ With a possible reservation in favour of one or more hexereis in Sicily, n. 51.

⁹¹ Polybius has been so abused for saying that the Romans had no experience of building quinqueremes and required a Carthaginian model, that I feel the utmost diffidence in suggesting that the basis of the story is merely

that the Carthaginians had got the new system and the Romans had not. Polybius does *not* say that they copied a stranded quinquereme; he says (1, 20, 15) that they built their whole fleet (*i.e.* quinqueremes and triremes) on the model of a stranded *cataphract*. Ihne's criticism (*Röm. Gesch.* 2, 49), that they had Syracusan models to hand, is beside the point. We, for instance, had many English models to hand in the Napoleonic war; yet I have read that we often copied the lines of French prizes.

⁹² According to Diod. 19, 62, three ennereis and ten dekereis were built. This may be an anticipation; anyhow, they did not go into action. Plutarch gives no details of size. Beloch, *Gr. Gesch.* iii. 1, 159 n. 1, defends Diodorus' account, as against Niese, and says it is the best picture of a sea-fight of the time that we possess. This seems to overlook the battle of Chios just a century later.

action on the stern of his big ship, rejoicing in the battle, with his three armour-bearers fallen round him, is not only entirely in character with all that we know of Demetrius, but is the sort of picture that becomes traditional and gets handed down correctly. He gained a crushing victory, due to his own big ships which he had led in person (his other wing was defeated); and we might know, even if Diodorus had not expressly said so, that Demetrius, being such as he was, could not help sending the biggest ship he had to carry the news to his father. The impression the big ships made in the Hellenistic world was great; Demetrius built bigger and bigger; Lysimachus tried to rival him;⁹³ in mere size the Ptolemies soon went far ahead of all competitors. And in the face of this, how *can* the prow of Samothrace represent anything but Demetrius' hepteres, any more than a monument of Trafalgar could represent any ship but the Victory? And if this prow be a hepteres, the accepted theory goes by the board at once as regards heptereis.

Assmann's selection of a bireme to explain this monument seems most unfortunate. He calls it the 'swift Aviso' sent to carry the news. But Diodorus (20, 53) says a hepteres (τὴν μεγίστην ναῦν) was sent: and one cannot advance by throwing over even Diodorus without good reason and taking to guesswork. If it is to be a bireme, one must begin by showing that it has nothing to do with the battle of Salamis. But the real point is that there is no evidence for the use of biremes at all till far later. I may well have missed some inscriptions; but subject to this, I believe that *διήρης* hardly occurs in Greek at all, and not before Pollux (second century A.D.); biremis is not found in Latin literature before Caesar and Cicero, or referring to an earlier period than theirs⁹⁴; *δίκροτος* has already been dealt with,⁹⁵ and only takes us back to the Mithridatic wars.

There is then no reason for calling the prow of Samothrace a bireme. Its elucidation as such is a good instance of a method which seems to me a wrong one.

The Dipylon 'biremes' have been explained as a first attempt at perspective,⁹⁶ and this may be true; but they may also be due simply to the

⁹³ Lysimachus' great okteres, the λεοντοφόρος, is said to have distinguished itself in the sea-fight between Ptolemy Keraunos and Antigonos Gonatas; Memnon 13 = *F. H. G.* 3, 534, τὸ ἐξαιρετικὸν ἔφερον. The change of system obviously came in before this ship was built, whatever Memnon's description exactly means.

⁹⁴ Livy 24, 40 (nuntiantes, Philippum primum Apolloniam tentasse, lembis biremibus centum viginti flumine adverso subvectum) is an apparent instance to the contrary. But we know all about these lembi, which Philip had built on the Illyrian model (Polyb. 5, 109) and which fought so well at the battle of Chios; and they were certainly not biremes (n. 60). The explanation is flumine adverso; they were

going up stream and to get more power the oars had been double-banked for the occasion. Double-bank, 'to provide . . . with two rowers for each oar'; see Murray's *Dict. s.v.* I wish to thank my friend Mr. Colin Campbell for calling my attention to this word, which he tells me is still in use, and which aptly explains this puzzling passage. As to Pliny 7, 56, see Appendix.

⁹⁵ See n. 40.

⁹⁶ Pernice, *Geometrische Vase mit Schiffdarstellung* (Jahrb. 1900, p. 92), on the ship published by the late Dr. A. S. Murray, *J.H.S.* 1899 (vol. 19), 198. I gather that in 1900 Pernice no longer held the view he had taken in 1892 as to the fragments of dipylon-ships,

desire of a very crude artist to show two sets of oars because he *knew* that a ship had a set on each side.⁹⁷ It is difficult to see how any one ever took such a ship as that in *J.H.S.* 1899, Pl. VIII., for a bireme of two superposed banks; for even an artist of the Dipylon period may be supposed to have known that oars should be able to reach the water and not stop short in mid-air. And if, as Pernice, Helbig, and von Wilamowitz have supposed, these Dipylon ships are Athenian, how came Athens to return for a couple of centuries to the more humble ships of a single bank? A question often asked and never answered. Assmann avoids it by calling the Dipylon ships Phœnician.

There are three Assyrian reliefs from the palace of Sennacherib, one in the British Museum, and two figured but not brought home by Layard, of which one has no ram. These shew oars in two rows, at no great interval of height, arranged in a zigzag thus, the lower oars in the intervals of the upper ones. The same thing is shewn on two ships on an Athenian B.-F. vase of about 500 B.C. (*B.M. Vases*, B. 436), and possibly in the ship on an Etruscan B.-F. vase (*B.M. Vases*, B. 60), though this latter is of little value for the arrangement of the oars. None of these ships can be biremes, which are unknown to every writer before Cæsar. The silence of Thucydides, who gives a sort of history of shipbuilding, is most material.

The Praenestine 'bireme.' According to Assmann, this relief belongs to the time of Augustus; according to Torr, to about 50 A.D. It shews two superposed banks with a very small interval between them; perhaps it would be more correct to say it shews the arrangement The higher bank issues from the outside of, the lower from the under part of, the *παρεξέσπερα*. The distance between the banks is too small for the accepted theory, to which it gives no support; but if it is in fact a bireme, then it may support Bauer's theory for *biremes of the early empire*. Whether it really is a bireme seems to me, I confess, very doubtful. Biremes were undoubtedly light and swift; but, allowing that in this relief, if to scale, the oars would be longer and the men smaller, it remains anything but a light or speedy-looking ship; compare it with the Isis-temple ships, for instance. Then it carries a *turris*. We do not know that a bireme never carried a tower, certainly; but we do not know that it did; I think the smallest ship referred to with a *turris* is Eudamus' quadrireme at Side (Livy 37, 24), and after all one can only argue from the facts that are known.

Figs. 5 and 6 in his article in *Ath. Mitt.* 17. Assmann claims to have refuted Pernice, (*Arch. Anz.* 1901, p. 98); and his point, that the Dipylon chariots shew one horse *beyond* and not *over* the other, is a fair one. But he does not (apparently) deal with the three things that seem conclusive, viz. :—(1) the supposed upper deck has no supports; (2) the supposed upper oars are cut off short on reaching the (supposed lower) deck, *i.e.*, fall on the other side of it; and (3) the steersman is lower than the supposed

upper rowers.

⁹⁷ It is well known that almost all beginners will try to draw, not what they see, but what they know to be there. A case exactly in point appears to me to be the idea of some savages, that a drawing in profile represents half a man only. This would meet Assmann's point about the chariots. It is easy to shew the further horse *beyond* the other, but very difficult thus to shew the further oarsmen.

The Palazzo Spada and Ludovisi reliefs.⁹⁸ These are Roman copies of the same Hellenistic original, of unknown date. The arrangement resembles that in Fig. 2, *ante*, and the original may have been a bireme; but it may just as well have had several men to an oar. And the two copies do not agree. If it was a bireme, then Luebeck's definition in Pauly-Wissowa is wrong, for its oars form one line in the water and not two.

Now as to the 'bireme' question generally. If the holes in the prow of Samothrace are portholes, and supposing that the Praenestine ship is not a biremis at all, but a large admiral-ship, as is possible—note the laurel-wreath—we get a breit-polyeres system in which two oars appear at unequal levels, a hepteres, *e.g.*, being rowed by three and four men to the oars respectively; again as at Venice.⁹⁹ This seems to me quite possible, and would explain the fact that every monument that we possess which shews or appears to shew any form of superposition (except the two ships at Naples, Trajan's column, and the Dipylon vases) never shews anything but two rows arranged thus; and we may perhaps imagine, founding ourselves on the Assyrian reliefs and the black-figure vases mentioned before, that such an arrangement of two rows has nothing whatever to do either with banks or ordines or the terms ending in -*ηρης*, but is merely an arrangement of old standing in the Eastern Mediterranean, applicable in many forms. As we possess very many references to triremes, quadriremes, and quinqueremes, and (omitting inscriptions of the Empire) very few indeed to biremes, to call nearly every monument a bireme is a historical absurdity. I would suggest that from early times there were two arrangements; in one the oars issued from the ship in a straight, in the other in a zigzag, line; from the former was developed the trireme; the latter, perhaps in abeyance in the 5th and 4th centuries, was again utilised, perhaps with modifications, for some of the larger polyereis of Hellenistic and Roman times. This seems at any rate worth consideration.¹⁰⁰ We have to explain Demetrius' hekkaidekerēs somehow and two oars of eight men apiece would be more feasible than one of sixteen.¹⁰¹ As to what the zigzag arrangement precisely means, I have no theory; what is and is not mechanically possible in the way of alternation must be left to others to say. I merely note the lines on which it would

⁹⁸ Schreiber, *die Hellenistische Reliefbilder*, Pls. 10 and 23^a respectively. See the two together in *Dar.-Sagl.* s. v. *navis*.

⁹⁹ For such a hepteres at Venice, Fincati, p. 196. It does not however appear if the oars in the Venetian ship were at unequal levels.

¹⁰⁰ Though I do not accept Bauer's hypothesis of the larger polyereis, I thoroughly agree with his conclusion; '[Meiner Hypothese zufolge] ist es unmöglich, den Typus eines Schiffes nach der Zahl der auf einer Darstellung sichtbaren Ruderreihen zu bestimmen' (p. 463).

¹⁰¹ Nothing larger than a dekerēs is known to have gone into action; nor does it appear

that in mediaeval times more than ten men to an oar were ever known. It is possible that the performance of Demetrius' hekkaidekerēs, which so pleased Plutarch's authority, (*Dem.* 43 τὸ τάχος καὶ τὸ ἔργον ἀξιοθαυτάτερον τοῦ μεγέθους), was only a 'contractor's trial' with a picked crew and very favourable conditions. Yet Philadelphos' extraordinary fleet (*Ath.* 203d) cannot have been merely for shew; though the account may be exaggerated, as Beloch supposes. Livy's translation of *εκαιδεκήρης* (n. 82) seems to dispose of the otherwise attractive view that the higher terms were arbitrary and merely denoted so much extra tonnage.

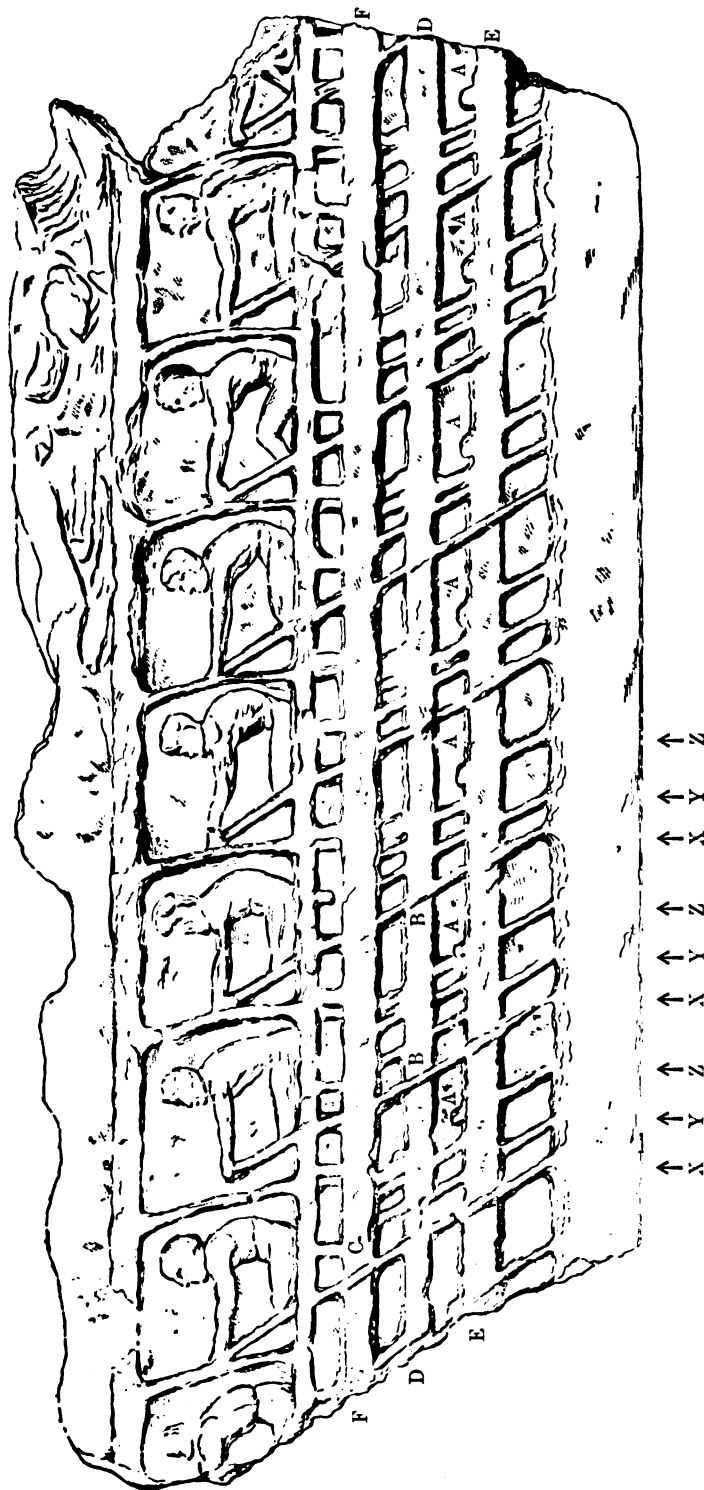


FIG. 3.—THE (SO-CALLED) LENORMANT RELIEF.
 Reproduced by the kind permission of Mr. Torr from the plate in his 'Ancient Ships.' The lettering is mine.

appear that the 'bireme' problem must be solved, if due regard be paid to the evidence; and I rather think that the bireme is the key to the whole matter. For instance, I know of no evidence that the oars of any ship ever formed two distinct lines in the water, let alone more than two.^{101a}

There remains the so-called Lenormant relief, (Fig. 3), which has (unfortunately) caught the popular imagination as the one remaining representation of a trireme, largely owing no doubt to the inaccurate representations originally published. As soon as accurate plates were available, the idea that Y and Z were the oars of the two lower banks was seen to be untenable in its original form, which took both Y and Z across the timber EE and made AA the portholes of the lowest bank ZZ.¹⁰² Assmann accordingly, while still calling Y and Z the 'zugite' and 'thalamite' oars, has to place their ports below or under EE, (there is no sign of such ports in the relief itself), and to treat the design in effect as an abnormal trireme, with a very long 'thranite' bank and two stunted lower banks of almost equal length; and this explanation has been largely accepted.

If we take the relief as it now is, and if it is to be a trireme, no explanation but Assmann's is possible, as I think will appear from the subjoined letter¹⁰³ from Mr. R. Carr Bosanquet, who, in reply to some questions of mine, kindly examined the original for me, not knowing for what purpose I required it done. As to the matter of paint, or low relief, now lost, this is of course a double-edged weapon; and I submit that it is indisputable, either that we must take the relief as we find it, or that we must say that it is too worn to draw any deductions from, one way or the other. The *raised* lumps AA cannot of course be portholes, as Assmann saw.

Granted, however, that, if this relief is to be a trireme, Assmann's explanation is, on the facts before us, the only possible one, it is not easy to take it seriously. Why are we entitled to invent portholes, when the relief

^{101a} One of Weber's points is the single line in the water.

¹⁰² Even as late as 1896 Eins is said to have taken Y, and Haack (whose paper I have also not seen) Y and Z, across EE. Since this went to press, I see that the older view is still taken by Torr in *Dar.-Sagl*, and by Mr. E. Conybeare, *Triremes*, 1904.

¹⁰³ 'No sign of Y and Z crossing *over* the transverse pieces. The surface is much weathered and perished, and they may have done so in very low relief, now lost—or even in paint; no doubt the thing was made far more intelligible by the colouring (of which naturally no trace remains, but it must have been there). AAA are rounded knobs projecting vertically above the transverse strip E, but with their faces in the same plane as the face of E.' . . .

'I think Torr's drawing (which I have examined since looking at the stone) exaggerates the disturbed surface of the water; there is a raised lump where X meets the water in the case of oarsmen 1, 3, 4. No such lump in the case of Y and Z; but this must not be pressed.' All these points come out clearly on a cast in the Inner Temple Library, which also shews another point referred to by Mr. Carr Bosanquet, and not appearing in Fig. 3, *viz.*, that X seems to pass over F in the case of oarsmen 3, 6, and 8, as well as 1. The raised lump in the water round X, as compared with the smoothness where Y and Z meet it, is most distinct in this cast. The figure in Baumeister, reproduced by Luebeck, is from a cast in Berlin, but is (admittedly) much touched up and 'completed.'

does not shew them, and when there is no evidence, monumental or otherwise, for portholes¹⁰⁴ low down on the ship's side in a polyeres? How, if we are to invent them, can they be placed 10 inches, or even a foot,¹⁰⁵ above the normal waterline, where the least sea would prevent the oarsmen from clearing the water, and where a slight roll, or some change in the waterline,¹⁰⁶ would send them under water altogether? And how, if we do place them there, could the oars be got in and out quickly in the face of the enemy, as was done?¹⁰⁷ And why, if this be an Athenian trireme, has it no *παρεξειρεσία*, which is well attested by Thucydides for the fifth century and Polyænus for the fourth? And why are Y and Z to be distinguished from the precisely similar streak (not lettered) running parallel to the upper part of Y, which cannot by any possibility be an oar?

Neither are we justified in supposing this to be an abnormal trireme. There probably *was* another type, the trihemiolia;¹⁰⁸ but short of elucidating this relief as a trihemiolia, should anyone care to, we are bound to suppose that triremes, at one and the same time, were all of one type as regards the arrangement of the oars.¹⁰⁹ Fifth century: Thuc. 2, 93; Brasidas led over the Isthmus crews from the fleet of the allies, furnished by a number of different states; they all brought their oars, confident that these would fit the Megarian triremes at Nisaea; and they did. Fourth century: for Athens alone the lists are conclusive. For Athens and Sparta, excerpta Polyæni 40, 2, Iphicrates deceives the Laconisers of Chios by sailing in *κόσμφ Λακωνικῶ*: had there been a difference in oarage he could not have hidden

¹⁰⁴ Even Mr. Torr's storehouse of quotations fails here. Herod. 5, 33 (which I shall come to presently) is certainly not such evidence. Pollux' *τρήματα* is quite satisfied by openings in the *παρεξειρεσία*; and none other appear on the Praenestine and Palazzo Spada ships, and perhaps I may add on the prow of Samothrace. (The portholes *are* however low on the Delphi ship, which is a moneres; but the gunwale is low also). *θαλαμία* is not connected with thalamite, technically, and does not mean the thalamite ports, but any port (Ar. *Ach.* 553) or any opening (Ar. *Peace*, 1232).

¹⁰⁵ Torr, p. 45, who takes AAA as the thalamite portholes, about one foot above the water, but points out the difficulty of squeezing in the rowers.

¹⁰⁶ See section D (*d*), and n. 75.

¹⁰⁷ Polyæni. 5, 22, 2. Note that the oars were not merely drawn inboard, but taken right out. The same manœuvre in Polyæni. 1, 47, 1; 3, 11, 3; excerpta Polyæni 57, 9. This is obviously dead against the portholes being covered with leather bags, the only alleged support for which is the Praenestine ship. There is no proof that the Athenian *ἀσκόματα*

were such; the only passage is Zonaras, who shews his ignorance by saying that the *ἀσκόματα* were fastened to the oars, the Athenian lists shewing that they were fastened to the trireme. Pollux 1, 85 τὸ πρὸς αὐτῷ τῷ σκαλμῷ *δέρμα ἄσκωμα* is more likely to be correct. But I suppose that the notion that the most intelligent people in the world first 'honeycombed' the sides of their triremes with holes larger than a man's head, and then covered the holes with leather bags to keep out the water, will die very hard. Why some of the text book writers believe that the oars were put out from the inside, blades first, instead of having the handles passed in from outside, is to me a puzzle. It also seems to me to be a grave question whether oars could be rowed at all through the *sides* of a boat as light as a trireme without pulling her to pieces in a short time.

¹⁰⁸ See n. 11.

¹⁰⁹ I do not mean more than 'at the same time.' We cannot for instance prove that the arrangement of the fourth century was that of the first. See however under F. Some writers assume a new arrangement of oars to explain each monument.

it, but must have betrayed himself at once. So exc. Pol. 58, 3. And as a general maxim of warfare, the same in exc. Pol. 57, 1. We *do* hear of considerable differences between the models of different states, both as to triremes and quinqueremes, but always in one respect only, weight or stoutness; a difference of oarage is never hinted at.

But the real objection to Assmann's view is, that it demands (judging by eye) an upper bank of oars that shall be more than twice the length of the two lower banks. Such a ship is impossible; for if one thing be more certain than another, it is that oars of different lengths, where the difference bears more than a certain proportion to the length, cannot be rowed together, by one man to an oar, so as to be of any real use or turn out an efficient ship. That they might be rowed together in a certain way for a short time I do not deny; but the huge increase in the ratio of dead weight to power would at once put an end to all idea of speed or efficiency.¹¹⁰

The Lenormant relief is, in fact, a moneres, and a simple one, as Bauer has always said;¹¹¹ and Y and Z are part of the hull.

F.

I trust I have now made probable the five propositions with which I started. The deductions from them—remembering that we have to do with reasonable probabilities only and not certainties—are, first, that a quinquereme of the last three centuries B.C. was a comparatively light galley of five men to an oar; secondly, that the ships from hexereis to dekereis may have been similar galleys of so many men to an oar, or may have been some other form of scaloccio galley, *e.g.*, one rowing two sets of oars in the arrangement; and thirdly, that Roman biremes may well have been nothing but double-banked monereis, perhaps modified a little; this last however is mere opinion.

It is however pretty clear on the evidence that the accepted theory

¹¹⁰ I am bound to refer to this controversy, on which so much has been written in Germany, and which has produced the greatest gem of the whole trireme-literature, the theory that the 'thalamites' may have taken 4 strokes and the 'zugites' 2 to the 'thranites' 1, *because* a pianist can play in three-time with one hand and four-time with the other. Given more than a certain proportionate difference in length, it is matter of mathematical demonstration, as well as practical knowledge, that the oars cannot be rowed together by one man to each oar so that each oar should do its best and each man pull his weight, *i.e.*, his own and his share of the ship's; and therefore each added bank after the first means a relative loss in power, owing to the

disproportionate increase in dead weight. Schmidt here *almost* takes up the position that, if practical oarsmanship forbids his deductions, so much the worse for practical oarsmanship: the 'thranites' had '*erheblich* längere Riemen. . . . Um diesen Schluss kommen wir nun einmal nicht herum, wir mögen uns drehen und wenden, wie wir wollen. Die namhaft *verschieden langen* Riemen, also auch *alle ihre Konsequenzen*, sind feststehende Tatsache' (p. 17; italics mine). Once more, whatever thranite means, there is no evidence of any sort that the thranite oars were *much* longer than the others.

¹¹¹ Bauer remained of the same opinion after examining the original; see his review of Schmidt in *Neue Phil. Rundschau*, 1900 p. 301.

cannot apply to any of the above; but the question of the trireme, Greek and Roman, and of the quadriremes and quinqueremes of the fourth century, is still open.

Herod. 7, 36: Xerxes' bridge over the Hellespont was laid on triremes and pentekontors. They were therefore of approximately equal height; and this seems to me very strong against the accepted theory, as regards Phoenician and Ionian triremes of 480 B.C.

Assuming the similar low elevation of an Athenian trireme, which is also a necessary consequence of its shallow draught, there remain only two theories, those of Bauer and Fincati respectively. To adopt Bauer's, one has to say, first, that the Praenestine ship is a bireme, and, secondly, that one can argue from a Roman bireme of the time of Octavian to a Greek trireme of the time of Pericles. Both these views are feasible enough, and I think therefore that Bauer's theory must remain a possible one. But for my part I do feel a great difficulty in arguing from a given monument to a ship of four centuries earlier. It is a question of individual opinion, no doubt; a rowing galley has only limited possibilities of development, and the great pace at which ancient fleets were built, indubitable even if exaggerated in detail, may well point to stereotyped models; but if I am right as to biremes not being in use till the first century B.C., I do not feel that they can have much bearing on the Athenian trireme. If this should be correct, the direct evidence for Bauer's view of the Athenian trireme has gone. Moreover I do not think Bauer claims that his view will explain the fourth century quadriremes and quinqueremes, which must be explained; and it may be that Fincati's will.¹¹²

Was a trireme then in the nature of a zenzile galley, with three men on a bench?

Galen, *de usu part.* 1, 24. Why are the fingers of different lengths and the middle one the longest? In order that when they close round an object the ends may come equal. So in triremes¹¹³ the ends of the oars all fall even (*i.e.*, make one line in the water) though the oars are not of equal length; for there too (*i.e.*, in the trireme as well as the hand) the μέσαι are made the longest (note that he refers to the oars and not only to the inboard portions) *for the same reason*. These last words can only mean 'in order that the ends of the oars may form one straight line like the ends of the fingers.' Now if any oars were the longest, considered as a group, it was the thranite oars,

¹¹² Fincati seems clear that no zenzile galleys larger than triremes were in use at Venice; but it is generally asserted, on Pantera's authority, that quinqueremes a zenzile were used. In Pantera's time the zenzile galley was only a memory. A thing might however be feasible with the shorter Athenian oars that was not so with the Venetian. How many difficulties would be avoided if one could only agree with Beloch (*Gr. Gesch.* 2, 470) that the

Athenian lists do not really prove that the oars of a trireme were used for a quadrireme.

¹¹³ καθάπερ οἶμαι κἂν ταῖς τριήρεσι τὰ πέρατα τῶν κωπῶν εἰς ἴσον ἐξικνεῖται, καίτοι γ' οὐκ ἴσων ἀπάντων ὄντων. καὶ γὰρ οὖν κακεῖ τὰς μέσας μεγίστας ἀπεργάζονται διὰ τὴν αὐτὴν αἰτίαν.—πέρατα cannot of course refer to the handles, which did not, and could not, come εἰς ἴσον on any conceivable theory, except Graser's.

and not those amidships (zugite). μέσαι then is not zugite (probably if he had meant zugite he would have said zugite); and the μέσαι had¹¹⁴ to be longest so as to get all the ends level. μέσαι then are the oars of the horizontal row or ordo nearest to the middle line of the ship drawn from stem to stern, and the trireme known to Galen was a breit-polyeres, probably in the nature of a zenzile galley;¹¹⁵ for the oars, if the ordines were distinguished by their position relative to the long axis of the ship, must have been all on a level, or thereabouts.

Now arises the question, is Galen an independent authority or is he using or referring to Aristotle (*Mech.* 4)?¹¹⁶ First, let us assume that he is using Aristotle.

As the text stands, Aristotle begins by saying (1) that the μεσόνεοι do most work; (2) that the fulcrum of the oar-lever is the thole. (2) is of course wrong in fact; if then (1) was right in fact, the μεσόνεοι must in fact have had the longest oars; and, if the passage is to agree with Galen, as explained above, the μεσόνεοι must also have had more oar inboard than the others, and so Aristotle says: ἐν μέσῃ δὲ τῇ νηὶ πλείστον τῆς κώπης ἐντὸς ἐστίν. So far all is plain sailing. Then come the following words, explaining μέσῃ; καὶ γὰρ ἡ ναὺς ταύτη εὐρυτάτη ἐστίν, ὥστε πλείον ἐπ' ἀμφοτέρα ἐνδέχεσθαι μέρος τῆς κώπης ἐκατέρου τοίχου ἐντὸς εἶναι τῆς νεώς, i.e., μέσῃ means amidships, and the whole passage, as a source for Galen, becomes nonsense. The rest of the chapter (allowing for the mistake as to the fulcrum) is excellent sense and suits Galen very well. If then Galen was using this chapter, he was using a text in which the words καὶ γὰρ ἡ ναὺς, etc., did not occur, and I may therefore strike out these words as a gloss. But perhaps these words do suit Galen, and it is only my explanation of Galen that is wrong? This, I think, is forbidden by Galen's words, διὰ τὴν αὐτὴν αἰτίαν.

Suppose now that Galen was not using or referring to Aristotle. He is then an independent authority; but one must attempt to construe the more important Aristotle on the basis of the words καὶ γὰρ ἡ ναὺς, etc., forming part of the text. The passage refers to the inboard length of the oars ἐν μέσῃ τῇ νηὶ. νηὶ here is either confined to a moneres or not. If it is, as is often assumed, then the passage construes well enough, but has no bearing whatever on the accepted theory, or my theory, or any other theory. But if νηὶ refers to, or includes, a trireme (as it obviously must), then, (if the words καὶ γὰρ ἡ ναὺς, etc., be included) μέσῃ means amidships, μεσόνεοι mean what I call zugites, and my zugites do more work than my thranites: and as this

¹¹⁴ This (the word αἰτία) is conclusive against μέσαι here meaning amidships, whatever theory we adopt as to the trireme; for the oars amidships would not have to be the longest to make the ends come level; indeed if they were the longest the ends would not come level. It seems equally conclusive against Conybeare's view that μέσαι means the middle of three superposed banks.

¹¹⁵ The explanation is substantially Fincati's, though he does not apply it to Galen. He says they had two zenzile triremes at Venice, in one of which the oars formed one even line in the water. To the same effect is Aristot. *de part. anim.* 4, 10—the handle of the κώπη μεσόνεως traverses a greater space.

¹¹⁶ The chapter is too long to cite in a note.

will not do, the passage must be taken to shew that the term 'zugites' means a row or ordo, and not a squad; this is of course against me.¹¹⁷ Assuming then for a moment that it *does* shew that the zugites were an ordo (and it does not matter now whether we take the accepted theory, or Bauer's, or Fincati's, they all agreeing that the zugites were an ordo), we land in a very grave difficulty over the *παρεχειρεσία*. This must of course have formed a straight line parallel (more or less) to the long axis of the ship, and not a curved line following the ship's side, one object being to give the oars all along approximately equal leverage throughout each ordo;¹¹⁸ and if so, the oars amidships of any ordo could not be longer inboard (*i.e.*, from the *σκαλμός*) than the others of the same ordo in any ship, such as a trireme, which carried a *παρεχειρεσία*, the *σκαλμοί* being of course in the *παρεχειρεσία*. If then this is well founded, *μέση* cannot mean amidships, and therefore *μεσόνεοι* must have the same meaning as in Galen,^{118a} and I may omit the words *καὶ γὰρ ἡ ναῦς*, etc., as a gloss added by some one who was ignorant of the *παρεχειρεσία* and was thinking of a ship with a curved side. If this be done, Aristotle means what Galen means. I do not then myself think that Aristotle is against me: but I hope I have stated the difficulty fairly.

I need only refer to two other passages. Polyæn. 3, 11, 7; Chabrias, training some new men, took out the triremes' oars, and placing on the beach great logs (*ξύλα μακρά*), so that the men sat one by one (*ὥστε ἐφ' ἓνα καθῆσθαι*), thus taught them. I think the natural meaning is that in the trireme they did not sit ἐφ' ἓνα (else why be at pains to mention that they so sat on the beach?), but ἐπὶ some other number, *i.e.*, ἐπὶ τρεῖς, three on a bench; but I cannot press this. Herod. 5, 33. If a trireme was a zenzile galley, with the three oars issuing side by side from one opening, we can explain what Skylax' head was put through. The idea of a porthole for one oar larger than a man's head is not only unlikely in itself,^{118b} but flatly contradicted by every published monument known to me that shews portholes: and Herodotus does *not* speak of the man's head as being near the water, as many seem to assume.

The evidence then, for what it is worth, though terribly scanty and unsatisfactory, does lend colour to the idea that, as regards triremes, Fincati is, in the main outlines, right:¹¹⁹ and we come round once more to the

¹¹⁷ The argument under *B*, *C*, *D*, and *E* is independent of the meaning of 'zugite.'

¹¹⁸ This was the object of the *telaro* in the mediaeval galley, and of the first importance, as Jurien de la Gravière points out. It gave the boat, seen from above, the look of a parallelogram with two projecting ends; see the frontispiece and pl. 7 in Furtenbach, also the rearmost trireme in Fig. 1, *ante*. If I am right, then the *παρεχειρεσία* itself, though possibly inclining (as from stern to bow) somewhat

toward the long axis of the ship, must have been somewhat broader at the bow end than amidships; and this agrees well with Thuc. 4, 12, where Brasidas falls wounded and swooning on to the *παρεχειρεσία* and does not roll off.

^{118a} I take *μεσόνεοι* to be a technical term; something like *vogue-avante*.

^{118b} Even Assmann now doubts it; *Jarhb.* 1905, p. 89.

¹¹⁹ Fincati could at least claim that his boat would go: according to a writer in the

conclusion to which we have been tending throughout this paper, that the course of development in the Aegean was very similar to that which took place later in the Adriatic.¹²⁰ Differences in detail, of course, there must have been;¹²¹ but the conclusion as a whole does not seem to be in conflict with common sense.

One thing however seems to me to be abundantly clear: no evidence has yet been put forward that compels, or even seriously invites, us to believe in the accepted theory: and it is to be remembered that the burden of proof is on those who uphold that theory.

W. W. TARN.

APPENDIX.

I have received from Mr. Cecil Torr a number of critical notes on both parts of the above article, and by the courtesy of Mr. Torr and of the editors of this Journal it has been arranged that the substance of them shall be here published, with my replies. Mr. Torr's remarks are given verbatim as far as possible, in inverted commas.

p. 139. If the rowers were in three divisions, 'how did they get their names? I conceive that the thalamites sat in the thalamos, or hold; the zugites sat on the zuga, or beams, which formed the upper limit of the hold; and the thranites sat on thrani, or thranyes, which were seats above the beams.'—There is I think no evidence for these thrani; and as to thranites, I should adopt Prof. Ridgeway's suggestion (*Class. Rev.* 1895, p. 166), and derive the term from *θρήνυς*, the elevated step or platform at the *stern* on which stood the helmsman. As to thalamites, when an open boat first began to be partly decked, there would be a thalamos or cabin in the *bow*; hence the name. In Timaeos ap. Ath. 2, 37d *θαλαμοί* are the cabins of a merchant ship; and I know of no passage where the word simply means 'hold.' Pollux 1, 87 says that the *ἔδαφος τῆς νεώς* was called *κύτος καὶ γάστρα καὶ ἀμφιμήτριον*, and that in the part where the thalamites sat it was also called *θάλαμος*.

Academy, 1883 p. 219, it attained the great speed of 9 miles an hour, *i.e.*, nearly three-quarters of the pace of an average University crew from Putney to Mortlake. Unfortunately I have never seen any details of what the boat exactly was.

¹²⁰ So far as we have gone, there has been nothing to lead one to distinguish the Roman trireme from the Greek. It is however just possible that in Polyb. 1, 20, 15, we have a reference to a trireme a scaloccio; the Romans, he says, built their whole fleet (quinqueremes and triremes) to a Carthaginian model; and if, as suggested in this paper, the quinqueremes had 5 men to an oar, these Roman triremes may have had 3. This would only accord still further with what happened at Venice, where

triremes on both systems are said to have been built. But even were this so, the scaloccio trireme (if I am right as to Galen's meaning) was not the one that survived in the Aegean. At Venice, the galleys a scaloccio killed the trireme a zenzile.

¹²¹ The length of the oars, for instance. It might be attractive guesswork that the bench rose a little from the ship's side inboard and that the oars had separate portholes very close together; this would much resemble Bauer's theory, I think, and might be a useful subject for experiment. It has been suggested by Mr. Cook, whose citation of the *τρίσκαλοι νᾶες* of Aesch. *Pers.*, 679, for the zenzile trireme is most happy, as a reference to Fig. 2 (*ante*) will shew.

- pp. 140, 141. Polyæn. 5, 43 and 3, 11, 14; Polyb. 16, 3. 'The Athenian triremes had sixty-two oars in the thranite (or highest) bank, fifty-four oars in the zugite (or middle) bank, and fifty-four in the thalamite (or lowest) bank. Consequently, the thranite bank of oars was longer than either the zugite or the thalamite bank. And this would naturally be the case, for all three banks would start from abaft the catheads, and the thranite (or highest) bank could extend further back toward the stern than the other two banks, owing to the sharpness of the run in ancient ships.' The three passages in question refer 'to the part of the stern to which the thranite bank extended.'—The numbers 62, 54, and 54, are the highest of various numbers given for triremes by the Athenian lists; but it does not follow that all these oars were in use at once. However, if Mr. Torr could shew that Calliades' ship was an Athenian trireme, and that a trireme had three superposed banks, his explanation might do for Polyæn. 5, 43. It cannot apply to the *trihemiolia* in Polyb. 16, 3, which was rammed *κατὰ μέσον τὸ κύτος*; and Polyæn. 3, 11, 14 depends on the meaning of *παρεξαιρεσία*; see post.
- p. 140. 'In rendering Polyæn. 5, 43, the word *πηδάλιον* is taken three times to mean "steerage" and once to mean "stern." It really means "steering-oar." The phrase *τὸ πηδάλιον ἔσχαζε* is translated "kept using his steerage." It means "kept lifting his steering-oar out of the water," i.e. ceasing to use it for steering.'—'Stern' does not occur in my rendering of Polyænus, but in my own account of what happened, and is not meant for a translation of *πηδάλιον*. There is no instance, I think, of *σχάζω* meaning 'to lift.' It means 'to cut'; and when it is used in the phrase *κώπην σχάζειν*, 'to stop rowing,' the meaning is that the oar is (naturally) dropped flat on the water, so that the edge of the blade cuts through the surface; this was known to the Scholiast on *Clouds* 107 *σχάσαι γὰρ δεῖ καὶ ὥσπερ διαστεῖλαι καὶ διασχίσαι τὸ ὕδωρ τὴν κώπην*, though he is mistaken in adding *ἐρέσσουσιν*. From this meaning again are derived two others (*ἀπὸ μεταφορᾶς τῶν ἐρεσσόντων*); simply 'to stop,' and simply 'to drop' (Xen. *Kyn.* 3, 5). *ἔσχαζε τὸ πηδάλιον* is then 'he kept dropping his steering-oar into the water,' i.e. making use of it; and this is the only rendering of the passage that makes sense, for Calliades must have turned his own ship now to one side and now to the other in order to avoid the enemy *καθ' ὁπότερον ἂν ἐμβάλλειν μέλλοι*. No doubt it was a technical term.
- p. 141. Note 10. "'The new steering-oars were through the *παρεξαιρεσία*: therefore, the old ones were not." This does not follow. Polyænus says *διὰ τῆς παρεξαιρεσίας κατὰ τὰς θρανίτιδας κώπας*. He is specifying a point in the *παρεξαιρεσία* further forward than the position of the old steering-oars, namely, the point to which the thranite oars extended. Then as to *παρεξαιρεσία* in *Peripl. Pont. Eux.* 2, "the reference must be to a *higher* point, not a *different* point," i.e. from *κατὰ τὰς κώπας*. Of course, it is a *higher* point, because the ships were higher out of water at the ends (*παραξαιρεσίαι*) than in the middle (*κατὰ τὰς κώπας*). But, unless it is a different point, the passage is meaningless. Then, Thucydides vii, 34 is made to mean exactly the reverse of what it does mean. The ships met the others bow to bow (*ἀντίπρωροι*) and were damaged in the parts next the bow (*παραξαιρεσίαι*). It is unfair to Thucydides to make him say that the ships met bow to bow and thereby damaged themselves amidships. "But the absolutely decisive passage is Polyænus, iii, 11, 13. Chabrias stretches skins over the *παρεξαιρεσία* of *each side* of the ship and nails them to the deck above, thus making a *φράγμα* which prevented the waves washing in and the oarsmen looking out." If the sea had been abeam, he would only have put the skins along the windward side of the ship. As he put them on *each side* of the ship, it must have been a head sea or a following sea; and, as one of his objects was to prevent the rowers seeing the approaching waves, it must have been a following sea, for the rowers faced aft. In fact, there was a following sea in which his ship was likely to be pooped, and he protected her at the stern (*παρεξαιρεσία*).—I think there is no passage in which *παρεξαιρεσία* must mean

stern or bow, and cannot mean an outrigger or some analogous structure. I grant that *Peripl. Pont. Eur.* 3 can be taken either way; and that Polyæn. 3, 11, 14 is not quite conclusive; though if *παρεξαιρεσία* be the stern, why is it mentioned at all? And how is *διά* to be construed? Did Chabrias cut a hole in the timbers of the poop? (*Anc. Ships* fig. 36 illustrates *how* he put out his new steering-oars, I think.) Thuc. 7, 34 states that no Athenian ship sank, but seven became *ἄπλοι*, *ἀναρράγισαι τὰς παρεξαιρεσίας*. It is incredible that none sank if their bows were torn open. Two triremes ramming bow to bow would rarely meet stempost to stempost with accuracy; the stems would slide each past the other, and carry away the forepart of the opponents' outrigger, which extended most of the ship's length. (I said nothing about 'amidships.') This was why the Syracusans strengthened their *ἐπωτίδες*, i.e. the forward ends of the outriggers. Cf. the distinction between *ἀναρρήξαι τὴν παρεξαιρεσίαν* and *ἀναρρήξαι τὴν πῶραν* in Pollux 1, 124. Polyæn. 3, 11, 13 is decisive that the *παρεξαιρεσία* was something extending along each side of the ship so far as the rowers extended. Chabrias stretched skins *ὑπὲρ τὴν παρεξαιρεσίαν ἐκατέρου τοίχου* (which in silver Greek can only, I submit, mean the *παρεξαιρεσία* of each side of the ship), and nailing them to the deck above made a *φράγμα πρὸς τὰς παρεξαιρεσίας* (plural), which (among other things) prevented the men getting wet and prevented them seeing the waves, *οὐχ ὁρῶντες διὰ τὴν τοῦ φράγματος πρόσθεσιν*. No arrangement on the stern could possibly have this effect, apart from the reference to cataphracts in *φράγμα*; and Chabrias could not possibly have carried out his idea *at sea*, with a crew so nervous that he was afraid of their upsetting the boat. The old interpretation of *παρεξαιρεσία* as stern or bow is in fact a guess of the scholiast on Thucydides from the look of the word, *τὸ παρὲξ τῆς εἰρεσίας*.

Mr. Torr then refers to Dr. Assmann's view of the *παρεξαιρεσία*, which I have adopted, as being based on a misinterpretation of the prow of Samothrace, the projections on which (as in *Ancient Ships*) he calls cat-heads, comparing a coin of Cios (*Anc. Ships* fig. 23).—I have nothing to add to what I have said on this monument. But if one can prove the outrigger from the texts, it lends much support to Dr. Assmann's view that what the monument shews is an outrigger.

pp. 142, 143. 'I am not concerned with evidence of class (2). But Pollux 1, 87, shews by his mention of *θάλαμος*, *ζυγά*, and *κατάστρωμα* that he supposed the banks of rowers to be superposed.'—The most that can be claimed for Pollux is, that he can be read to suit either theory, like many other passages. But he does not refer to triremes only; he is speaking generally; and for three centuries the standard warship had been the quinquereme. As to there being three classes *only*, Mr. Torr says 'The men in the highest bank of the tesserakonteres were called *thranites*, as was to be expected; but nothing whatever is known about the names for the men in the other banks in the tesserakonteres, or any other ships of higher rank than triremes.'—One cannot *disprove* this; but we have no right to confine Pollux 1, 87 and 119 to triremes, and most recent writers have taken the simple view, that in all ships there were only three classes. It is a pity that the text of Polyb. 26, 7, 10 is corrupt.

pp. 143, 144. 'The forms "*τετρακίπορος* and so forth" may not occur, but their equivalents do. Aelius Aristides, *Rhodiaca* p. 341 *δικρότους καὶ τρικρότους καὶ εἰς ἑπτὰ καὶ εἰς ἑννία στοίχους*.'—*ἑπτὰ στοίχους* is *septem ordines*, which we know (from Livy and Eutropius) would be the translation of *ἑπτήρης*; it is not *ἑπτακίπορος*. In the second century A.D. *δίκποροι* were probably biremes; and *τρικρότους* is used here for 'triremes' because the writer has just used *τρίρεις* for 'warships.' A professional rhetorician like Aristides could not write *τρίρεις ὑπῆρχεν ἰδεῖν, διήρεις καὶ τριήρεις καὶ εἰς ἑπτήρεις καὶ ἑννήρεις*, which is what he means; he has done all he can to vary the *sound*, that is all.

pp. 144, 145. App. *Mith.* 12. 'There is nothing there to shew that the term *δίκπορος*

excludes hemiolia. I conceive that *δίκροτος* includes hemiolia as well as the true bireme and the bireme of the Liburnian type. Appian's statement is that the pirates gave up using myoparones, and took to using *δίκροτοι* of other sorts besides the hemioliai, and also triremes.' Then follows the explanation of hemiolia as a two banked ship given in *Ancient Ships*, for which there is no evidence.—As this is important, I quote Appian (Mendelssohn). *πειρατὰς . . . οἱ τὸ μὲν πρῶτον ὀλίγοις σκάφεσι καὶ μικροῖς οἷα ληστὰι περιπλέοντες ἐλύπουν, ὥς δὲ ὁ πόλεμος ἐμῆκύνετο, πλέονες ἐγίγνοντο καὶ ναυσὶ μεγάλας ἐπέπλεον. . . ἀντὶ τῆς γῆς ἐκαρποῦντο τὴν θάλασσαν, μυοπάρωσι πρῶτον καὶ ἡμιολίαις, εἶτα δίκροτοις καὶ τριήρεσι κατὰ μέρη περιπλέοντες.* To the man who wrote this, *ἡμιολία* and *δίκροτος* are mutually exclusive terms; and Mr. Torr's explanation is forbidden by the Greek.

pp. 144, 145. Arr. *Anab.* 6, 5, 2. 'The context shews that these *δίκροτοι* were hemioliai. By making the statement refer to triakontors, instead of hemioliai, the author has to shew that *κάτω* does not mean lower; and he does not seem to me to shew it.'—Once it is established from Appian that the hemiolia is not *δίκροτος*, the meaning of *κάτω* follows with almost mathematical precision.

p. 146. Mr. Torr claims *διήρης* and *δίκροτος* in Pollux 1, 82 as synonyms. It is not very important; but no doubt by the second century A.D. they were practically synonyms.

p. 150. App. *b.c.* 4, 85. 'Some ships got into the whirlpool at Scylla, and the crews were upset, not being used to it. It seems forcing the translation to say that the men were knocked off their legs rather than off their seats.'—I submit that *οὔτε ἐστῶτες βεβαίως* cannot possibly refer to sitting.

p. 154. 'Oros. 6, 19 is quoted as if he were contrasting Antony's dekereis with other dekereis, whereas he is contrasting them with the ships in Octavian's fleet which were all smaller than dekereis.'—Very possibly this is right; but it does not affect the other evidence for the size of Antony's ships. They must have resembled galeasses.

Note 80. 'See *Anc. Ships* p. 57, n. 131' which states that *ζυγόν* in *Agam.* 1618 is some bench at the stern.

p. 205. 'Florus ii. 21 (iv. 11) uses *remorum* and *remigum* indifferently, because there was one man to one oar.'

p. 206. 'The Trajan column trireme cannot be ignored. It is not true that the oars "are just plastered on anyhow." They are clearly intended to be arranged in *quincuncem* . . . which is the natural developement of the zigzag . . . that you mention in the biremes.'—But what the monument *shews* is not a quincunx at all, but . . . ; and is not that 'anyhow'?

p. 207. The prow of Samothrace. 'Your argument for the hepteres, which you develop at so much length, does not seem to have very much foundation. How can one assume that it has anything to do with Demetrius' victory at Salamis? And why should Nike be travelling about on one of Demetrius' ships rather than her own? Her ship was a familiar thing before that date; see *Revue Arch.* 26 (1895) p. 161.'—Mr. Torr's article in the *Revue Arch.* gives two figures of Nike, one on, and one hovering over, the prow of a ship; but there is nothing to suggest that the ship is Nike's own ship. Is there any other evidence? As to the Nike of Samothrace, Demetrius' well-known coins shew that she was set up to commemorate some victory of his by sea, and we know of no other but Salamis; had there been any other of importance, Plutarch would hardly have passed it over.

Note 94. 'I conceive that these lembi were narrow enough to have the oars sculled in pairs.'—No doubt biremis *can* mean a sculling boat; but had Philip two complete fleets of lembi? Or did he put sculling boats into line against the Rhodian quinqueremes at Chios?

- p. 209. The Dipylon ship *J.H.S.* 1899, Pl. 8. 'I doubt if it is a bireme. I am in favour of its being a ship of a single bank with *περίνεα* oars rowed from the *κατάστρομα*.' —I by no means exclude the idea that (say) a state ship might have been thus rowed; I believe there is a case at Venice, and possibly Antigonos' *τριάρημος* was something of the kind. But in the case of this Dipylon ship the explanation does not seem to meet any of the three difficulties given in n. 96.
- p. 209. As to biremes being unknown to every writer before Caesar. 'Damastes (*apud* Plin. vii. 56 (57), 207) attributes the invention of biremes to the Erythraeans; and Damastes was a contemporary of Herodotus. Also in the catalogue of the ships *Il.* 2, 509, 510, there is a pretty clear allusion to biremes.'—The allusion in the *Iliad* is merely to ships with 120 men each. As to Pliny. It is not a case of Damastes *apud* Plinium, but of an assertion of Pliny's own, even supposing Damastes of Sigeum to be meant; and Pliny's list is quite untrustworthy. 'Biremem Damastes Erythraeos fecisse: triremem Thucydides Aminoclem Corinthium (our Thucydides says nothing of the sort, see 1, 13, 2; it is Pliny's own interpretation of him); quinqueremem Mnesigiton Salaminios (directly contradicted by the circumstantial account in Diodorus); ab ea (hexeres) ad decemremem Mnesigiton Alexandrum Magnum (almost certainly untrue, see note 51). In the face of this kind of thing, Pliny's statement as to Damastes is of very slight value. No doubt a bireme was experimented with before a trireme; my point is that it never came into use *at all* in early times, while Mr. Torr thinks it did, and was driven out by the trireme. Then why no reference to it?
- p. 209. 'If Sennacherib's ships are not biremes, what are they?'—I do not know. But if the pentekontor was really not invented till 704 B.C., they cannot be *long* ships at all. I think they are *round* ships (see figs. 10 and 11 in *Anc. Ships*) beginning to be adapted for fighting; two have rams, one has none.

Mr. Torr does not comment on the difficulty I have felt and expressed over the bireme question generally.

'Lenormant relief. I have no doubt at all about the accuracy of what you call the older view. "The *raised* lumps A A cannot of course be portholes." They presumably are portholes with *ἀσκήματα*. "And Y and Z are part of the hull." Similar reasoning would make X part of the hull; which it certainly is not. Why should not Y and Z cross E E (the lower waling piece) just as much as X crosses D D and E E (the two waling pieces) and F F (the gunwale)? If the relief disproves one, it disproves the other.

'I presume you admit that X are oars rowed against tholes on the gunwale F F, and that D D and E E are the waling pieces. Then one gets the ports (with *ἀσκήματα*) of the third bank just where one expects to find them, namely between the two waling pieces and vertically below the tholes of the first bank. One would expect to find the ports of the second bank between the upper waling piece and the gunwale. The difficulty of course is that the oars of the second bank (Y) seem to go right up to the lower side of the gunwale. Now there is a double set of supports under the gunwale, one running down to the upper waling piece and the other running down to the lower waling piece. One explanation is that the sculptor was rather careless, and continued the oars (Y) as far as the gunwale in the same way as these supports. Another explanation is that these supports imply that the gunwale projected a little way over the side of the ship, and thus hid the portholes.

'I think my diagram, D. and S., fig. 5275, helps one to understand this relief.' —I submit that this is reconstruction, not explanation; precisely as fig. 5275 in Dar.-Sagl. is. The monument shews that X crosses D D, E E, and F F, and does not shew that Y and Z cross E E: that is the point. One cannot reconstruct a relief on the footing that it has to shew three banks, and then use it as evidence that there *were* three banks.

- Note 107. 'Polyaen. 5, 22, 2 is not conclusive that the oars could be got out quickly. Diotimos would begin getting his oars out as soon as the enemy saw his hulls, say five miles off. The stratagem would answer only so long as his ships were hull down. But the passage seems to me to shew that the oars could not have been passed in from the outside, as you suggest. Pollux, I think, is wrong; the thing that he mentions was called *τροπός* or *τροπωτήρ* and *καπητήρ*, not *ἄσκαμα*.'—Diotimos must have let the enemy come close up, or he could have got back to harbour; but I have omitted the words 'is conclusive' from the note. But the *practical* difficulty of getting out the oars at all, whether from inside or otherwise, in a trireme arranged on the accepted theory is to my mind prohibitive. Whether Pollux here be right or wrong (I think he is right), there is no real evidence for the current view of the *ἄσκαμα*. Its use was to lessen friction.
- n. 107. 'The latter part of this note seems to rest on a misconception. The portholes did not serve as rowlocks. The oars were rowed against tholes.'—By all means. My difficulty, *i.e.* the strain on the ship's timbers, remains (she was very lightly built); and I should like an expert opinion. I am thinking of the way a racing eight strains in spite of every precaution.
- p. 215. Herod 7, 36. 'Probably the bridge had longer supports where the supports rested on pentekontors than where they rested on triremes.'—Perhaps. The bridge was laid on great cables. No doubt it may be possible to get round the question of *height* as regards a trireme; it is with the quinquereme that it becomes so formidable.
- p. 215. Galen. Mr. Torr is inclined to think that he is referring to one *tier* of the trireme's oars only and also to the aspect of the oars inside the ship. The word *αἰρία* I think forbids this, as I have shewn (n. 114). It also assumes that there *were* tiers, which is rather the point at issue.
- p. 216. As to Aristotle. I do not reproduce Mr. Torr's criticism because (given his premisses) everyone will agree. If there was no such thing as an outrigger, and if Galen is not using Aristotle, (these are his premisses), then *μεσόνεοι* are the men amid-ships, and Aristotle is against my view under A. But if either of these premisses be false, my argument holds. Anyhow Mr. Torr does not claim that Aristotle supports the theory of superposed banks, for he says 'Aristotle is stating a general proposition, *i.e.* he refers to any tier of oars (it does not matter whether the ship had one or more).'
- p. 217. Polyaen. 3. 11, 7 *ἐφ' ἑνα*. 'I take this to mean that each pair of rowers (port and starboard) sat on the same piece of timber, instead of sitting on separate seats. Cf. Leo, *Tactica* 8 and Ap. Rhod. 1, 395, 396 quoted in *Anc. Ships*, notes 46 and 110.'—Neither of these passages refers to triremes, and I doubt if the above explains *ἐφ' ἑνα*; but I have said that I cannot press the passage.
- Finally, Mr. Torr considers it hazardous to say that something which existed in the mediaeval type existed in the ancient type unless one can shew that it existed also in the intermediate or Byzantine type. But I claim neither continuity of tradition nor identity; only analogy.

Mr. Torr sums up as follows:—

'As to your propositions.

A. I do not see that you have any evidence at all for the assertion, "thranites astern, zugites amidships, thalamites in the bows." Your evidence is only that the thranites were furthest astern. And there is quite another explanation of that, namely, that the thranite bank, which had sixty-two oars, reached further aft than the zugite and thalamite banks, which had only fifty-four.

B. To establish this translation of the terms *τρίκροτος*, etc., you would have to show that *δίκροτος* and *ἡμιολία* are mutually exclusive in App. *Mith.* 92, and that *κάτω* does not mean *lower* in Arr. *Anab.* vi. 5, 2.

C. Of course, there is a danger in generalizing from a limited number of instances ; but, I think, people were aware of that already.

D. I cannot find anything in your paper to support D (1), and hardly anything in support of D (2). Of course, D (2) is really a question for a naval architect ; and I fancy he would decline to express an opinion without more *data* than can be given him.

E. This is supposed to be dealt with in Part II., but I do not see that you have really tackled the question.'

W. W. TARN.